

APPENDIX F THROUGH I  
DRAFT REMOVAL ACTION WORK PLAN  
SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

**Prepared for**

U.S. Environmental Protection Agency, Region 6

**On behalf of**

McGinnes Industrial Maintenance Corporation  
and  
International Paper Company

**Prepared by**

Anchor QEA, LLC

**September 2010**

SUBMITTED SUBJECT TO AND WITHOUT WAIVING ARGUMENTS RAISED BY RESPONDENTS IN  
THEIR SEPTEMBER 10, 2010 NOTICES OF DISPUTE RELATED TO EPA'S MODIFICATION OF  
RESPONDENTS' PROPOSED FLOW DESIGN FOR TCRA ALTERNATIVE 3.

# APPENDIX F

## HEALTH AND SAFETY PLAN/JOB SAFETY ANALYSIS FORMS

### TIME CRITICAL REMOVAL ACTION

### SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

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**Prepared for**

U.S. Environmental Protection Agency, Region 6

**On behalf of**

McGinnes Industrial Maintenance Corporation

and

International Paper Company

**Prepared by**

Anchor QEA, LLC

614 Magnolia Avenue

Ocean Springs, Mississippi 39564

**September 2010**

# HEALTH AND SAFETY PLAN

## SAN JACINTO RIVER WASTE PITS

### SUPERFUND SITE

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#### **Prepared for**

McGinnes Industrial Maintenance Corporation

International Paper Company

U.S. Environmental Protection Agency, Region 6

#### **Prepared by**

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Building D, Suite 3

Ocean Springs, MS 39564

**December 2009**

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## CERTIFICATION PAGE

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David Keith, Ph.D., R.G., C.HG.  
Project Manager  
Anchor QEA, LLC

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Jason Kase  
Field Lead  
Anchor QEA, LLC

Date: \_\_\_\_\_

Date: \_\_\_\_\_

The information in this Health and Safety Plan has been designed for the Scope of Work presently contemplated by Anchor QEA, LLC (Anchor QEA) for this Site; however, that scope of work is not yet fully understood. Therefore, this document may not be appropriate if the work is not performed by or using the methods presently contemplated by Anchor QEA. In addition, as the work is performed, conditions different from those anticipated may be encountered and this document may require modification. Therefore, Anchor QEA only intends this plan to address currently anticipated activities and conditions and makes no representations or warranties as to the adequacy of the Health and Safety Plan for all conditions encountered.



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## HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT FORM

Project Number: 090557-01

Project Name: San Jacinto River Waste Pits

My signature below certifies that I have read and understand the policies and procedures specified in this Health and Safety Plan (HASP). For non-Anchor QEA employees, this HASP may include company-specific appendices to this plan developed by entities other than Anchor QEA.

Date	Name (print)	Signature	Company

Health and Safety Plan Acknowledgement Form

Date	Name (print)	Signature	Company

## SITE EMERGENCY PROCEDURES

### Emergency Contact Information

**Table A**  
**Site Emergency Form and Emergency Phone Numbers\***

Category	Information	
Possible Chemicals of Concern	Dioxins/Furans	
Minimum Level of Protection	Level D	
Site(s) Location Address	(no formal address see Figure A) Channelview, TX 77530	
Emergency Phone Numbers		
Ambulance	911	
Fire	911	
Police	911	
Poison Control	911 and then 1-800-222-1212, if appropriate	
Client Contact - McGinnes Industrial Maintenance Corporation (MIMC)	Andrew Shafer	Office: (713) 647-5460 Cell: (832) 724-3802
Client Contract – International Paper (IP)	Phil Slowiak	Office: (901) 419-3845 Cell: (901) 214-9550
Project Manager (PM)	David Keith	Office: (228) 818-9626 Cell: (228) 224-2983
Field Lead (FL)	Jason Kase	Office: (850) 912-8400 Cell: (251) 259-7196
Corporate Health and Safety Manager (CHSM)**	David Templeton	Office: (206) 287-9130 Cell: (206) 910-4279
National Response Center	1-800-424-8802	
State Emergency Response System	(512) 424-2138	
EPA Environmental Response Team	(201) 321-6600	

\* In the event of any emergency contact the PM and FL.

\*\* Integral Consulting Inc. (Integral) will be active on the site during some of the field activities anticipated for this project. The Corporate Health and Safety Manager (CHSM) for Integral is Eron Dodak; his phone numbers are: Office (503) 284-5545 x14; Cell (503) 407-2933. In event of an emergency involving Integral staff, Mr. Dodak must be contacted. Additional Integral contacts will be included in the addendums of this HASP that will be developed as part of task-specific Sampling and Analysis Plans (SAPs). Field personnel should refer to the HASP addenda that accompany the program-specific SAP for detailed emergency contacts.

**Figure A**  
**Site Location Map**



**Table B**  
**Hospital Information**

Category	Information
Hospital Name	Triumph Hospital – East Houston
Address	15101 East Freeway
City, State	Channelview, TX 77530-41041
Phone	(713) 691-6556
Emergency Phone	(713) 691-6556

**Figure B**  
**Hospital Route Map**



### **Hospital Route Map and Driving Directions**

1. Head west on East Freeway Service Road toward Monmouth Street (approximately 0.9 miles)
2. Take the ramp on the left to I-10 West
3. Proceed on I-10 West to Exit 781B (approximately 3.7 miles)
4. Exit freeway at Exit 781B onto East Freeway Service Road
5. Continue heading west on East Freeway Service Road (approximately 0.2 miles)
6. Triumph Hospital will be on the right (total distance approximately 5 miles)



Figure C  
Access to I-10 West



Figure D  
Hospital Detail (Egress from I-10 West)



## Key Safety Personnel

The following people share responsibility for health and safety at the site. See Section 4 of this HASP for a description of the role and responsibility of each.

Client Contact: Andrew Shafer (MIMC)	Office: (713) 647-5460 Cell: (832) 724-3802
Client Contact: Phil Slowiak (International Paper)	Office: (901) 419-3845 Cell: (901) 214-9550
Project Manager (PM): David Keith	Office: (228) 818-9626 Cell: (228) 224-2983
Field Lead (FL): Jason Kase	Office: (850) 912-8400 Cell: (251) 259-7196
Corporate Health and Safety Manager (CHSM): David Templeton	Office: (206) 287-9130 Cell: (206) 910-4279

## Emergency Response Procedures

In the event of an emergency, immediate action must be taken by the first person to recognize the event. Use the following steps as a guideline:

- Survey the situation to ensure that it is safe for you and the victim. Do not endanger your own life. Do not enter an area to rescue someone who has been overcome unless properly equipped and trained. Ensure that all protocols are followed. If applicable, review Material Safety Data Sheets (MSDS) to evaluate response actions for chemical exposures.
- Call the appropriate emergency number (911) or direct someone else to do this immediately (see Table A). Explain the physical injury, chemical exposure, fire, or release and location of the incident.
- Have someone retrieve the nearest first aid kit.
- If necessary, decontaminate the victim without delaying life-saving procedures (see Section 8).
- Administer first aid, and if necessary, cardiopulmonary resuscitation (CPR), if properly trained, until emergency responders arrive.
- Notify the Project Manager (PM) and the Field Lead (FL).

- Complete the appropriate incident investigation reports.

### **First Aid and CPR Guidelines**

Personnel qualified and current in basic first aid and/or CPR procedures may perform those procedures as necessary. Personnel qualified and current in basic first aid and/or CPR are protected under Good Samaritan policies as long as they only perform the basic tasks that they were taught and if they have permission from a conscious victim. Do not perform first aid and/or CPR tasks if you have not been trained in first aid and/or CPR.

### **Injury Management/Incident Notification**

Observe the following injury management/incident notification procedures and practices:

#### ***Injury Management***

- Once a personal injury incident is discovered, the first action will be to ensure that the injured party receives appropriate medical attention.
- The nearest workers will immediately call 911 or the appropriate emergency number.
- If it is safe to approach the victim, ascertain the condition of the victim to communicate relevant information to the emergency response operator. If it is safe to do so, the nearest workers will immediately render first aid and assist a person who shows signs of medical distress or who is involved in an accident.
- Escort the injured person to the nearest hospital (see Figure B) or arrange for an ambulance.
- Proceed immediately to Notification Requirements, below.

#### ***Notification Requirements***

- Directly after caring for an injured person, the FL will be summoned. The FL will immediately make contact with the PM or other designated individuals to alert them of the medical emergency. The FL will advise them of the following:
  - Location of the victim at the work site
  - Nature of the emergency
  - Whether the victim is conscious



- Specific conditions contributing to the injury, if known
- The PM will contact upper line management, including the Corporate Health and Safety Manager (CHSM), and the clients' contact persons.
- The CSHM will facilitate the incident investigation

All client requirements will also be adhered to that are pertinent to personal injury incident reporting.

### ***Incident Other Than Personal Injury***

All incidents including, but not limited to, fire, explosion, property damage, or environmental release will be responded to in accordance with the site-specific Health and Safety Plan. In general, this includes securing the site appropriate to the incident, turning control over to the emergency responders, or securing the site and summoning appropriate remedial personnel or equipment. Anchor QEA will immediately notify both of the clients of any major incident, fire, equipment or property damage, or environmental incident with a preliminary report. A full report will be provided to both of the clients within 72 hours.

### ***Near-Miss Reporting***

All near-miss incidents (those that could have reasonably lead to an injury, environmental release, or other incident) must also be reported to the FL and/or PM immediately so they can take action to ensure that such conditions that lead to the near-miss incident can be readily corrected to prevent future occurrences.

### ***Spills and Releases of Hazardous Materials***

When required, notify the National Response Center and the Texas Department of Public Safety, as appropriate. The following information should be provided to the National Response Center and the Texas Department of Public Safety:

- Name and telephone number
- Name and address of facility
- Time and type of incident
- Name and quantity of materials involved, if known

- Extent of injuries
- Possible hazards to human health or the environment outside of the facility

The emergency telephone number for the National Response Center is 1-800-424-8802. The emergency telephone number for the Texas Department of Public Safety is 512-424-2138.

If hazardous waste has been released or produced during the incident, ensure that:

- Waste is collected and contained
- Containers of waste are removed or isolated from the immediate site of the emergency
- Treatment or storage of the recovered waste, contaminated soil or surface water, or any other material that results from the incident or its control is provided
- No waste that is incompatible with released material is treated or stored in the facility until cleanup procedures are completed
- All emergency equipment used is decontaminated, recharged, and fit for its intended use before operations are resumed.

### **HASP Modification**

This HASP will be modified by amendment, if necessary, to address changing field conditions or additional work tasks not already described in this document. Modifications will be proposed by the FL using the "Modifications to Health and Safety Plan" form included in Appendix A. Modifications will be reviewed and approved by the PM, in consultation with the CHSM.

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Appendix A	Health and Safety Logs and Forms
Appendix B	Material Safety Data Sheets (MSDS)
Appendix C	Job Safety Analysis (JSA) Documents

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## LIST OF ACRONYMS AND ABBREVIATIONS

° C	degrees Celsius
° F	degrees Fahrenheit
ACGIH	American Conference of Governmental Industrial Hygienists
Anchor QEA	Anchor QEA, LLC
ANSI	American National Standards Institute
APR	Air-Purifying Respirator
CFR	Code of Federal Regulations
CHSM	Corporate Health and Safety Manager
COC	chemical of concern
CPR	Cardiopulmonary resuscitation
CRZ	Contamination Reduction Zone
dB	decibel
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
EZ	Exclusion Zone/Hot Zone
FID	Flame Ionization Detector
FL	Field Lead
GFCI	Ground Fault Circuit Interrupter
HASP	Health and Safety Plan
HAZMAT	Hazardous Materials
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	High Efficiency Particulate Air
HMIS	Hazardous Material Information System
JSA	Job Safety Analysis
kPa	kilopascal
LEL	Lower Explosive Limit
LO/TO	Lockout/Tagout
mg/m <sup>3</sup>	Milligrams per cubic meter
MHR	Maximum Heart Rate
MSDS	Material Safety Data Sheets

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List of Acronyms and Abbreviations

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MIMC	McGinnes Industrial Maintenance Corporation
MUTCD	Manual of Uniform Traffic Control Devices
NEC	National Electrical Code
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NPL	National Priority List
O <sub>2</sub>	Oxygen
OEL	Occupational Exposure Limit
OSHA	Occupational Safety and Health Act or Administration
PAHs	Polycyclic Aromatic Hydrocarbon
P.E.	Professional Engineer
PEL	Permissible Exposure Limit
PFD	personal flotation device
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
ppm	parts per million
REL	Recommended Exposure Limits
RCRA	Resource Conservation and Recovery Act
STEL	Short Term Exposure Limit
SZ	Support Zone/Clean Zone
TLV	Threshold Limit Values
TSD	Treatment, Storage, and Disposal Facility
tsf	ton per square foot
TWA	Time Weighted Average
USCG	U.S. Coast Guard
VOC	Volatile Organic Compound
WBGT	Wet Bulb Globe Temperature



---

## 1 INTRODUCTION

This Health and Safety Plan (HASP) has been prepared on behalf of MIMC and International Paper Corporation and presents health and safety requirements and procedures that will be followed by Anchor QEA, LLC (Anchor QEA) personnel and other contractors during work activities at the San Jacinto River Waste Pits Superfund Site (the Site). This HASP has been developed in accordance with Title 29 of the Code of Federal Regulations (CFR), Part 1910.120 (b), and will be used in conjunction with Anchor QEA's Corporate Health and Safety Program. This HASP will be modified by addendum if the scope of these activities is modified in a way that is not addressed by this HASP, or if there is a change to key personnel.

The provisions of this HASP are mandatory for all Anchor QEA personnel assigned to the project. Other contractors that will be working at the Site are also expected to follow the provisions of this HASP unless they have their own HASP that covers their specific activities related to this project. Any other contractor HASPs must include the requirements set forth in this HASP, at a minimum. All visitors to the work site must also abide by the requirements of this HASP and will attend a pre-work briefing where the contents of this HASP will be presented and discussed.

Personnel assigned to work at the Site will be required to read this plan and must sign the Health and Safety Plan Acknowledgement Form to confirm that they understand and agree to abide by the provisions of the HASP.

Other contractors are ultimately responsible for the health and safety of their employees. Other contractors may mandate health and safety protection measures for their employees beyond the minimum requirements specified in this HASP.

The objectives of this HASP are to identify potential physical, chemical, and biological hazards associated with field activities; establish safe working conditions and protective measures to control those hazards; define emergency procedures; and describe the responsibilities, training requirements, and medical monitoring requirements for site project personnel.

This HASP prescribes the procedures that must be followed during specific site activities. Significant operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without the prior approval of the Project Manager (PM) and the Corporate Health and Safety Manager (CHSM).

Issuance of this approved plan documents that the workplace has been evaluated for hazards. A hazard assessment has been performed and the adequacy of the personal protective equipment (PPE) selected was evaluated as required by 29 CFR 1910.132(d) - Personal Protective Equipment, General Requirements (general industry), 1910.134 - Respiratory Protection, 1926.28 - Personal Protective Equipment (construction industry), and 1926.55 - Gases, vapors, fumes, dusts and mist, and is duly noted by the signature(s) and date appearing on the certification page of this document.

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## 2 SITE DESCRIPTION/BACKGROUND INFORMATION

### 2.1 Site Description

The Site is located on the western bank of the San Jacinto River, immediately north of the Interstate Highway 10 (I-10) bridge. Areas to the west and south of the Site are industrial, while areas east and north of the Site are either undeveloped or residential. Residential development on the eastern bank of the river occurs within 0.5 miles of the Site. The *Screening Site Inspection Report* (SSI) Report prepared by the Texas Commission on Environmental Quality in 2006 states that the former waste pits were comprised of a series of three or more surface impoundments reportedly used to dispose of wastewater treatment sludge from the Champion Paper Mill in Pasadena, Texas; however, correspondence and drawings from the Texas State Department of Health indicate that there were only two impoundments at the Site.

Pulp and paper waste was transported by barge to the Site and unloaded into impoundments formed by levees in 1965/1966. The Site property boundary consisted of more than 20 acres, slightly less than 15 acres of which were utilized.

There were two impoundments at the Site connected with a drain line to allow flow of excess water (including rain water) from Impoundment #1 to Impoundment #2. The waste materials in the ponds were reported to have the following characteristics:

- Primarily fibrous – the dried material was reported to resemble a cheaper grade of cardboard
- Near neutral pH
- Medium stiff to stiff
- Low permeability
- Organic base – grass could be grown on the material.

In a letter dated July 1966, the Texas Water Pollution Control Board stated that it was their understanding that the waste ponds would not be used again for the storage of waste materials.

## 2.2 Site Background Information

Environmental investigations will be performed to support the design of expedited measures as well as to support the selection and design of a permanent remedy for the site. Previous investigations of sediment quality were reviewed for the preparation of this HASP.

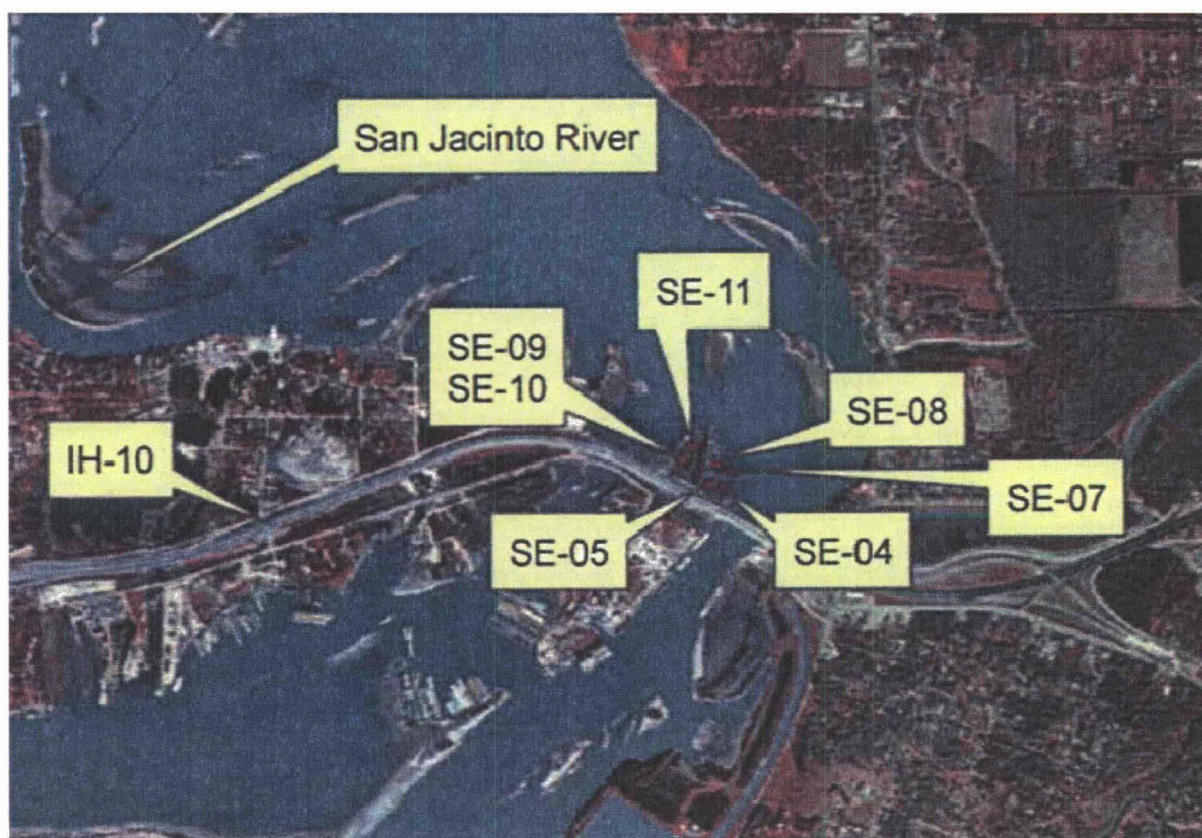
The SSI report reported the results of dioxin/furan and metals analyses of seven sediment samples collected near the site (locations SE-04, SE-05, and SE-07 through SE-11 on Figure 2 in the SSI report). The following table summarizes the maximum concentrations of dioxins/furans and metals reported in the SSI. Semivolatile organic compounds, pesticides, and polychlorinated biphenyls were not detected in the Site sludge materials. Volatile organic compounds were not analyzed for in the SSI.

**Table 2-1**  
**Concentration of COCs in Sediment**

Constituent	Maximum Concentration
<b>Dioxins/Furans (pg/g)</b>	
2,3,7,8-Tetrachlorodibenzo-p-dioxin	33,900
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	363
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	4.83
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	27.9
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	10.2
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	658
2,3,7,8-Tetrachlorodibenzofuran	51,200
1,2,3,7,8-Pentachlorodibenzofuran	4,970
2,3,4,7,8-Pentachlorodibenzofuran	2,470
1,2,3,4,7,8-Hexachlorodibenzofuran	7,530
1,2,3,6,7,8-Hexachlorodibenzofuran	2,240
2,3,4,6,7,8-Hexachlorodibenzofuran	427
1,2,3,7,8,9-Hexachlorodibenzofuran	795
1,2,3,4,6,7,8-Heptachlorodibenzofuran	2,460
1,2,3,4,7,8,9-Heptachlorodibenzofuran	960
<b>Metals (mg/kg)</b>	
Aluminum	22,100
Barium	244
Chromium	19.7

Iron	14,900
Lead	48.0
Magnesium	4,790
Manganese	790
Mercury	1.7
Nickel	14.0
Vanadium	34.4
Zinc	244

**Figure 2-1**  
Previous Sediment Sampling Locations



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### **3 SCOPE OF WORK**

#### **3.1 Project Scope of Work**

This plan addresses health and safety issues involved with the following field tasks:

- Sediment, soil, tissue, and surface water sampling to support the RI/FS
- Sampling to support the time-critical and nontime-critical removal action engineering design evaluations
- Oversight of site response construction activities

Tasks may be added to the project scope, and the details of the field tasks will be defined in the work plan documents that will be developed. Task-specific health and safety provisions, if not already covered by this HASP, will be developed and added to this HASP as addenda.

---

## **4 AUTHORITY AND RESPONSIBILITIES OF KEY PERSONNEL**

This section describes the authority and responsibilities of key Anchor QEA project personnel. The names and contact information for the following key safety personnel are listed in the Emergency Site Procedures section at the beginning of this HASP. Should key site personnel change during the course of the project, a new list will be established and posted immediately at the site. The emergency phone number for the site is 911, and should be used for all medical, fire, and police emergencies.

### **4.1 Project Manager**

The PM provides overall direction for the project. The PM is responsible for ensuring that the project meets the client's objectives in a safe and timely manner. The PM is responsible for providing qualified staff for the project and adequate resources and budget for the health and safety staff to carry out their responsibilities during the field work. The PM will be in regular contact with the Field Lead (FL) and CHSM to ensure that appropriate health and safety procedures are implemented into each project task.

The PM has authority to direct response operations; the PM assumes total control over project activities but may assign responsibility for aspects of the project to others. In addition, the PM:

- Oversees the preparation and organization of background review of the project, the work plan, and the field team.
- Ensures that the team obtains permission for site access and coordinates activities with appropriate officials.
- Briefs the FL and field personnel on specific assignments.
- Together with the FL, sees that health and safety requirements are met.
- Consults with the CHSM regarding unsafe conditions, incidents, or changes in site conditions or the anticipated Scope of Work.

The PM will have completed the required Occupational Safety and Health Administration (OSHA) 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER)

training and annual updates, the 8-hour Supervisor training, medical monitoring clearance (if necessary per requirements in Section 13).

## **4.2 Field Lead**

The FL reports to the PM, has authority to direct response operations, and assumes control over on-site activities. The FL will direct field activities, coordinate the technical and health and safety components of the field program, and is responsible in general for enforcing this site-specific HASP and Corporate HASP requirements. The FL will be the primary point of contact for all field personnel and visitors and has direct responsibility for implementation and administration of this HASP. The FL and any other member of the field crew have the authority to stop or suspend work in the event of an emergency, if conditions arise that pose an unacceptable health and safety risk to the field crew or environment, or if conditions arise that warrant revision or amendment of this HASP. The following include, but are not necessarily limited to, the functions of the FL related to this HASP:

- Conduct and document daily safety meetings, or designate an alternate FL in his or her absence.
- Execute the work plan and schedule.
- Conduct periodic field health and safety inspections to ensure compliance with this HASP.
- Oversee implementation of safety procedures.
- Implement worker protection levels.
- Enforce site control measures to ensure that only authorized personnel are allowed on site.
- Notify, when necessary, local public emergency officials (all personnel on site may conduct this task as needed).
- Follow-up on incident reports to the PM.
- Periodically inspect protective clothing and equipment for adequacy and safety compliance.
- Ensure that protective clothing and equipment are properly stored and maintained.
- Perform or oversee air monitoring in accordance with this HASP.
- Maintain and oversee operation of monitoring equipment and interpretation of data from the monitoring equipment.



- Monitor workers for signs of stress, including heat stress, cold exposure, and fatigue.
- Require participants to use the “buddy” system.
- Provide (via implementation of this HASP) emergency procedures, evacuation routes, and telephone numbers of the local hospital, poison control center, fire department, and police department.
- Communicate incidents promptly to the PM.
- Maintain communication with the CHSM on site activities.
- If applicable, ensure that decontamination and disposal procedures are followed.
- Maintain the availability of required safety equipment.
- Advise appropriate health services and medical personnel of potential exposures.
- Notify emergency response personnel in the event of an emergency and coordinate emergency medical care.

The FL will record health-and-safety-related details of the project in the field logbook. At a minimum, each day’s entries must include the following information:

- Project name or location
- Names of all on-site personnel
- Level of PPE worn and any other specifics regarding PPE
- Weather conditions
- Type of field work being performed.

The FL will have completed the required OSHA 40-hour HAZWOPER training and annual updates, the 8-hour Supervisor training, medical monitoring clearance (if necessary per requirements in Section 13), and current first aid and cardiopulmonary resuscitation (CPR) training. Other certifications or training may be stipulated based on client or site requirements.

#### **4.3 Corporate Health and Safety Manager**

Anchor QEA’s CHSM will be responsible for managing on-site health and safety activities and will provide support to the PM and FL on health and safety issues. The specific duties of the CHSM are to:

- Provide technical input into the design and implementation of this HASP.

- Advise on the potential for occupational exposure to project hazards, along with appropriate methods and/or controls to eliminate site hazards.
- Ensure that a hazard assessment has been performed and that the adequacy of the PPE selected was evaluated as required by 29 CFR 1910.132(d), 1910.134, 1926.25, and 1926.55, and is duly noted by the signatures and date appearing on the Certification Page of this document.
- Consult with the FL on matters relating to suspending site activities in the event of an emergency.
- Verify that all on-site Anchor QEA personnel and other contractors have read and signed the HASP Acknowledgement Form.
- Verify that corrective actions resulting from deficiencies identified by audit and observations are implemented and effective.

The CHSM will have completed the required OSHA 40-hour HAZWOPER training and annual updates, the 8-hour Supervisor training, and have medical monitoring clearance (if necessary per requirements in Section 13). In addition, the CHSM will have current training in first aid and CPR.

#### **4.4 Project Field Team**

All project field team members will attend a project-specific meeting conducted by the FL concerning safety issues and project work task review before beginning work. All field crew, including other contractors, must be familiar with and comply with this HASP. The field crew has the responsibility to immediately report any potentially unsafe or hazardous conditions to the FL, and all members of the field crew have the authority to stop or suspend work if conditions arise that pose an unacceptable health and safety risk to the field crew or environment, or if conditions arise that warrant revision or amendment of this HASP. The field team reports to the FL for on-site activities and is responsible for:

- Reviewing and maintaining a working knowledge of this HASP
- Safe completion of on-site tasks required to fulfill the work plan
- Compliance with the HASP
- Attendance and participation in daily safety meetings
- Notification to the FL of existing or potential safety conditions at the site

- Reporting all incidents to the FL
- Demonstrating safety and health conscious conduct.

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## **5 PROJECT-SPECIFIC REQUIREMENTS**

This section provides activity-specific levels of protection and air monitoring requirements to be used on this site based on the anticipated Scope of Work and the chemicals of concern (COCs).

### **5.1 Activity-Specific Level of Protection Requirements**

Refer to Section 10 of this plan for general requirements for PPE. Level D is the minimum acceptable level for most sites. An upgrade to Modified Level D occurs when there is a possibility that contaminated media can come in contact with the skin or work uniform. An upgrade to Level C occurs when there is a potential for exposure to airborne COCs; i.e., if the results of air monitoring reveal that action levels have been exceeded. Hearing protection must be worn when there are high noise levels. Workers must maintain proficiency in the use and care of PPE that is to be worn.

Table 5-1, Project Job Tasks and Required PPE, describes the specific means of protection needed for each identified work activity.

### **5.2 Project Air Monitoring Requirements**

Refer to Section 11 of this plan for general requirements for air monitoring at the project site, including information on air monitoring equipment. Previous investigations of the site indicate that the constituents of interest for worker health and safety during investigation and site response construction are dioxins and furans. There is no evidence of significant concentrations of volatile constituents in sediment or surface water. Therefore, respiratory protection is not expected to be needed and Modified Level D PPE should be appropriate for the entire investigation. Monitoring of the breathing zone will be performed during initial investigation activities, e.g., during collection of the first several sediment grab samples and cores. If air monitoring indicates the presence of unexpected concentrations of volatile organic compounds in the breathing zone, work will be suspended and the provisions of this HASP will be re-evaluated. Based on the results of the initial monitoring, the FL may decide to suspend further air monitoring if conditions warrant. Table 5-2, Project Air Monitoring Requirements, describes the specific air monitoring required for each identified work activity.

**Table 5-1**  
**Project Job Tasks and Required PPE**

Job Tasks	PPE Requirements
<b>EXAMPLES:</b> <ul style="list-style-type: none"> <li>Collecting sediment, soil, tissue and surface water grab samples</li> <li>Operation of sampling vessel and equipment</li> <li>Collection of sediment cores and processing sediment cores (visual inspection and subsampling)</li> </ul>	<input type="checkbox"/> Standard work uniform/coveralls
	<input type="checkbox"/> Work boots with safety toe
	<input checked="" type="checkbox"/> Traffic Safety Vest (when working in areas with vehicle traffic, heavy equipment)
	Chemical-resistant clothing check appropriate garments: <input type="checkbox"/> One-piece coverall <input type="checkbox"/> Hooded one- or two-piece chemical splash suit <input type="checkbox"/> Disposable chemical coveralls <input type="checkbox"/> Chemical-resistant hood and apron <input type="checkbox"/> Bib-style overalls and jacket with hood
	<input checked="" type="checkbox"/> <b>Fabric Type:</b> Tyvek NOTE: Thick rain pants and coveralls may be substituted for coated Tyvek if sediments are not obviously contaminated with polycyclic aromatic hydrocarbons (PAHs) or related petroleum products. Rain slickers cannot be effectively decontaminated of tar/petroleum contamination.
	<input checked="" type="checkbox"/> Disposable inner gloves (surgical) (required for all activities)
	Disposable chemical-resistant outer gloves
	<input checked="" type="checkbox"/> <b>Material Type:</b> Nitrile (required for equipment decontamination and sediment core collection, not required for core processing)
	Chemical-resistant boots with safety toe and steel shank or disposable boot covers for safety toe/work boots
	<input checked="" type="checkbox"/> <b>Material Type:</b> Rubber or leather with disposable boot covers, if terrain and ground conditions allow use of boot covers without unreasonable danger of slipping hazard)
	<input type="checkbox"/> Sleeves to be duct-taped over gloves and pants to be duct-taped over boots
	<input type="checkbox"/> Splash-proof safety goggles
	<input checked="" type="checkbox"/> Safety glasses (face shield may be substituted for safety glasses if splash hazard is too great to be controlled with safety glasses)
	<input checked="" type="checkbox"/> Hard hat (if overhead or falling object hazards are present)
	<input type="checkbox"/> Hard hat with face shield
	<input checked="" type="checkbox"/> Hearing protectors ( <b>REQUIRED</b> if site noise levels are greater than 85 decibels [dB] based on an 8-hour time-weighted average [TWA]). <b>Type:</b> Ear plugs
	<input type="checkbox"/> Two-way radio communication (intrinsically safe, if explosive atmosphere is a potential)

Project-Specific Requirements

Job Tasks	PPE Requirements
	<input type="checkbox"/> Long cotton underwear
	<input checked="" type="checkbox"/> U.S. Coast Guard (USCG)-approved personal flotation device (PFD)
	<input type="checkbox"/> USCG-approved float coat and bib-overalls (e.g., full two-piece "Mustang" survival suit or similar) or one-piece survival suit if water temperatures are below 50° F
	<input type="checkbox"/> Half-face Air-Purifying Respirator (APR) (OSHA/NIOSH-approved)
	<input type="checkbox"/> Full-face APR (OSHA/NIOSH-approved)
	<input type="checkbox"/> Type of Cartridges to be Used:
	<input type="checkbox"/> OV or <input type="checkbox"/> OV/HEPA (if samples are dry)

**Table 5-2**  
**Project Air Monitoring Requirements**

<b>Instrument*</b>	<b>Job Tasks / Functions</b>	<b>Measurement</b>	<b>Monitoring Schedule</b>	<b>Actions<sup>1</sup></b>
FID and/or PID - Measures Total Organic Vapors	Conduct air monitoring for volatile organic compounds (VOCs) initially during activities where VOC contaminated media may be present (during the collection of soil samples, sediment grab samples, and sediment cores). Make sure that a background reading is taken before the start of activities and periodically thereafter.	0 to 5 ppm above background in breathing zone	As soon as practical after collecting the grab sample or while pulling a sediment core sample onto the deck of the sampling vessel. The FL may suspend air monitoring based on data from the first several sampling locations.	Acceptable, continue work.
	The FL may discontinue air monitoring, in consultation with the PM, after reviewing monitoring results from initial sampling activities.	> 5 ppm above background in breathing zone		Stop work required <sup>2</sup> . Leave work area and contact Project Manager (PM) and Corporate Health and Safety Manager (CHSM) for guidance.

\*Note: Instruments must be calibrated according to manufacturer's recommendations.

1 For VOCs, a sustained reading for greater than 2 minutes in excess of the action level will trigger a protective measure.

2 Contact with the CHSM and PM must be made prior to continuance of work. A hazard review must be conducted before proceeding with work. Corrective actions may include temporary work stoppage to allow vapors to dissipate, and then returning to work if air monitoring data permits.

ppm – parts per million

mg/m<sup>3</sup> – milligrams per cubic meter

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## **6 RISK ANALYSIS AND CONTROL**

The following sections discuss the potential worker health and safety hazards associated with the potential field tasks associated with investigation activities that are anticipated for the Site. Controls of these hazards are addressed through the mechanical and physical control measures, use of PPE, monitoring, training, decontamination, emergency response, and safety procedures.

Significant changes in the anticipated Scope of Work covered by this HASP must be communicated to the PM and CHSM, and an amendment to this HASP must be created as needed. Any task conducted beyond those identified in the anticipated Scope of Work and this HASP must be evaluated using the Job Safety Analysis (JSA) process prior to conducting the work.

### **6.1 Job Safety Analysis**

Work tasks will be evaluated for their hazards, and JSA documents will be developed that detail the chemical, physical, and biological hazards associated with these tasks, along with the control measures (e.g., engineering controls, administrative controls, and/or PPE) that will be used to ensure that these tasks are conducted in a safe manner.

The PM and FL are responsible for identifying work tasks and project site conditions that are beyond JSA documents and the HASP for communicating such information to the CHSM. The CHSM will provide support, as needed, to the PM and/or the FL, who will have primary responsibility to develop project-specific JSAs.

The contents of the JSA documents shall be communicated to project personnel during the site orientation meeting and during daily safety meetings when conducting work where the specific JSAs are applicable.

JSA documents applicable to this project will be located in Appendix C of the HASP as it is amended.



## **6.2 Exposure Routes**

Possible routes of exposure to the chemicals potentially encountered on this project include inhalation, dermal contact, and ingestion of dust, mist, gas, vapor, or liquid. Exposure will be minimized by using safe work practices and by wearing the appropriate PPE. A further discussion of PPE requirements is presented in Section 10.

### **6.2.1 Dermal Contact**

Dermal contact with potentially contaminated soil, sediment, biota, surface water, or groundwater during field activities is possible. Direct contact will be minimized through the use of appropriate PPE and decontamination procedures.

### **6.2.2 Ingestion**

Direct ingestion of contaminants can occur by inhaling airborne dust, mist, or vapors, or by swallowing contaminants trapped in the upper respiratory tract. Indirect ingestion can occur by introducing the contaminants into the mouth by way of food, tobacco, fingers, or other carriers. Although ingestion of contaminants can occur, proper hygiene, decontamination, and contamination reduction procedures should reduce the probability of this route of exposure.

## **6.3 Chemicals of Concern Profile**

The following table provides a summary profile for the COCs related to worker safety for this field project. As available, this profile is based on recent site history and site characterization information. For more detailed and specific information, always refer to the Material Safety Data Sheet (MSDS) or equivalent information for the chemical (see Appendix B).

**Table 6-1**  
**Chemicals of Concern Profile**

<b>Chemical</b>	<b>Physical/Chemical Characteristics (Target Organs/Route of Entry)</b>	<b>OEL (STEL)</b>	<b>Odor Threshold</b>	<b>LEL (%)</b>	<b>IP (eV)</b>
Dioxins/Furans	Dermal contact, eye contact, ingestion, inhalation (dust)	N/A	N/A	N/A	N/A

**Notes:**

eV – electron volts

IP – Ionization Potential

LEL – Lower Explosive Limit

OEL – Occupational Exposure Limit (identifies the most restrictive exposure limit, e.g., federal or state OSHA, permissible exposure limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLV), and/or National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit (REL) for the chemicals of concern.

STEL – Short-term exposure limit

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## **7 SITE CONTROL AND COMMUNICATIONS**

The primary purposes for site controls are to establish the hazardous area perimeter, to reduce migration of contaminants into clean areas, and to prevent unauthorized access or exposure to hazardous materials by site personnel and the public. Site control is especially important in emergency situations.

### **7.1 General Site Control Safety Procedures**

The following are standard safe work practices that apply to all Anchor QEA site personnel and other contractors and shall be discussed in the safety briefing prior to initiating work on the site:

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited on site except in designated areas.
- Hands and faces should be washed upon leaving the work area and before eating, drinking, chewing gum or tobacco, and smoking.
- A buddy system will be used. Radio, cellular telephone, or hand signals will be established to maintain communication.
- During site operations, each worker will consider him/herself as a safety backup to his/her partner.
- Visual contact will be maintained between buddies on-site when performing hazardous duties.
- No personnel will be admitted to the site without the proper safety equipment, training, and medical surveillance certification.
- All personnel must comply with established safety procedures. Any staff member who does not comply with safety policy, as established in this HASP, will be subject to corrective action, potentially including, but not limited to, reprimanded and immediate dismissal.
- Proper decontamination procedures must be followed before leaving a contaminated work area.

## 7.2 Work Area Access Control

If work is performed in public areas, the following precautions shall be taken to protect both the workers and the public. Access control to the work area will be accomplished by the use of a combination of the following devices and/or methods:

- Fences and/or barricades
- Traffic control devices and/or use of flaggers
- Caution tape
- Other methods to keep the site secure and provide a visual barrier to help keep unauthorized personnel from entering the site and active work areas.

## 7.3 Hazardous Waste Site Work Control Procedures

To prevent contamination from migrating from personnel and equipment, work areas will be clearly specified as an Exclusion Zone/Hot Zone (EZ), Contaminant Reduction Zone (CRZ), or Support Zone/Clean Zone (SZ) prior to beginning operations. Each work area will be clearly identified using signs or physical barriers. At the end of each workday, the site should be secured and/or guarded to prevent unauthorized entry.

Site work zones will include:

- **Exclusion Zone/Hot Zone (EZ).** The EZ will be the “hot zone” or contaminated area inside the site perimeter (or sample collection area of boat). The EZ is the defined area where potential respiratory and/or health hazards exist. All personnel entering the EZ must use the required PPE, as set forth in this HASP, and meet the appropriate training and medical clearance. Entry to and exit from this zone will be made through a designated point. Appropriate warning signs to identify the EZ should be posted (e.g., DANGER, AUTHORIZED PERSONNEL ONLY, PROTECTIVE EQUIPMENT REQUIRED BEYOND THIS POINT). Personnel and equipment decontamination must be performed upon exiting the EZ.
- **Contaminant Reduction Zone (CRZ).** The CRZ, also known as the “warm zone,” is a transitional zone between the EZ and the SZ (also known as the “cold zone” or “clean zone”). The CRZ provides a location for removal and decontamination of PPE and tools leaving the EZ. A separate decontamination area will be established for heavy

equipment. All personnel and equipment must exit via the CRZ. If, at anytime, the CRZ is compromised, a new CRZ will be established.

- **Support Zone/Clean Zone (SZ).** This uncontaminated zone will be the area outside the EZ and CRZ and within the geographic perimeters of the site (including boat and processing areas). The SZ is used for support personnel; staging materials; parking vehicles; office, laboratory, and sanitation facilities; and receiving deliveries. Personnel entering this zone may include delivery personnel, visitors, security guards, and others who will not necessarily be permitted in the EZ or CRZ.

A log of all personnel visiting, entering, or working on the Site shall be maintained by the FL. No visitor will be allowed in the EZ without showing proof of training and medical certification, per 29 CFR 1910.120(e), (f). Visitors will attend a site orientation given by the FL and sign the HASP.

## **7.4 Site-Specific Work Zone Requirements**

This section contains guidelines for maintaining safe conditions when sampling, including work performed on a boat.

### **7.4.1 Sampling Work Zones**

Sampling and sample processing will occur within the EZ. The EZ will include, to the extent practical, a corridor between the boat access and the sample-processing area. Samples and contaminated equipment will be kept within the EZ until they are decontaminated and/or contained within coolers (samples) or other protective packaging (used equipment and investigation derived waste). Personnel and equipment leaving the EZ will exit through the CRZ, where contamination will be removed and disposable PPE will be discarded.

The vessel captain and the FL will delineate the boundaries of the work zones aboard the vessel and will inform the field crews of the arrangement. The purpose of the zones is to limit the migration of sample material out of the zones and to restrict access to active work areas.

Because space is limited on a sampling vessel, work zone designations are somewhat abbreviated and may need to be more flexible than when working on land. Two work zones will be observed aboard the vessel. Any area on a vessel where sampling activities are performed will be designated the EZ. Sediment cores and contaminated equipment will be stored in this work zone while they are transported to the upland sample processing area. Only the sampling crew may enter this zone unless assistance is required by other personnel. The second work zone will be for operating the vessel and storing clean equipment. To the extent practical, contaminated equipment and unprocessed samples, such as sediment cores, will be excluded from this relatively clean zone. Coolers of processed samples may be stored in this zone. Anchor QEA personnel will log and process the sediment cores on shore.

#### **7.4.2 Access Control**

Security and control of access to the sampling vessel and onshore area will be the responsibility of the captain and FL. Additional security measures may be placed into effect by the client, or as required by national security threat levels determined by the federal government. Access to the vessel and onshore areas will only be granted to necessary project personnel and authorized visitors. Any security or access control problems will be reported to the client or appropriate authorities.

##### **7.4.2.1 Safety Equipment**

In addition to PPE that will be worn by shipboard personnel, basic emergency and first aid equipment will also be provided. Equipment will include:

- U.S. Coast Guard (USCG)-approved personal flotation devices (PFDs)
- Emergency throw-ring (or similar)
- First aid kit adequate for the number of personnel
- Emergency eyewash.

Anchor QEA and/or other contractors working on Site will provide this equipment, which must be at the location(s) where field activities are being performed. Equipment will be checked daily to ensure its readiness for use.

## 7.5 Field Communications

Communications between all Anchor QEA employees and other contractors at the work site can be verbal and/or non-verbal. Verbal communication can be affected by the on-site background noise and various PPE. See Table 7-1 for a list of the types of communication methods and equipment to use, depending on site conditions. Communication equipment must be checked daily to ensure proper operation. All project personnel must be initially briefed on the communication methods prior to starting work; communication methods should be reviewed in daily safety meetings.

**Table 7-1**  
**Field Communication Methods**

Type of Communication	Communication Device	Signal
Emergency notification	On-site Telephone or Cellular Telephone	Initiate phone call using applicable emergency numbers
Emergency notification among site personnel	Two-way Radio or Cellular Telephone	Initiate communication with Code Red message
Hailing site personnel for non-emergency	Compressed Air Horn	One long blast, one short blast
Hailing site personnel for emergency evacuation	Compressed Air Horn	Three long, continuous blasts
Hailing site personnel for distress, need help	Visual	Arms waved in circle overhead
Hailing site personnel for emergency evacuation	Visual	Arms waved in criss-cross over head
Contaminated air/strong odor	Visual	Hands clutching throat
Break, lunch, end of day	Visual	Two hands together, break apart

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## **8 DECONTAMINATION PROCEDURES AND PRACTICES**

### **8.1 Minimization of Contamination**

The following measures will be observed to prevent or minimize exposure to potentially contaminated materials:

#### ***Personnel***

- Do not walk through spilled materials
- Do not handle, touch, or smell sample media directly
- Make sure PPE has no cuts or tears prior to use
- Protect and cover any skin injuries
- Stay upwind of airborne dusts and vapors
- Do not eat, drink, chew gum or tobacco, or smoke in the work zones.

#### ***Sampling Equipment and Vehicles/Vessels***

- Use care to avoid getting sampled media on the outside of sample containers
- If necessary, bag sample containers before filling with sampled media
- Place clean equipment on a plastic sheet to avoid direct contact with contaminated media
- Keep contaminated equipment and tools separate from clean equipment and tools
- Fill sample containers over a plastic tub to contain spillage
- Clean up spilled material immediately to avoid tracking around the vehicle/vessel

#### **8.1.1 Decontamination Equipment**

All vehicles, vessels, and equipment that have entered potentially contaminated areas will be visually inspected and, if necessary, decontaminated prior to leaving the area. If the level of vehicle contamination is low, decontamination may be limited to rinsing tires and wheel wells with an appropriate detergent and water. If the vehicle is significantly contaminated, steam cleaning or pressure washing may be required. Large tools will be cleaned in the same manner. Small reusable sampling equipment, including bowls, spoons, and knives, will be rinsed, washed in phosphate-free detergent, and rinsed again. Rinsate from all



decontamination activities will be collected for proper disposal. Decontamination of equipment and tools will take place within the CRZ.

The following supplies will be available to perform decontamination activities:

- Wash and rinse buckets
- Tap water and phosphate-free detergent (i.e., Alconox)
- Scrub brushes
- Distilled/deionized water
- Deck pump with pressurized freshwater hose (aboard the vessel)
- Pressure washer/steam cleaner, if appropriate
- Paper towels and plastic garbage bags.

#### **8.1.2 Personnel Decontamination**

The FL will ensure that all site personnel are familiar with personnel decontamination procedures as listed below. All personnel wearing PPE in a work area (EZ) must undergo decontamination prior to entering the SZ. Personnel will perform the following decontamination procedures:

- Wash and rinse outer gloves and boots in portable buckets to remove gross contamination. The surface of the site is contaminated with waste materials that will stick to boots. Disposable boot covers will be used if terrain and ground conditions are such that the use of disposable boot covers does not present a slipping hazard. If disposable boot covers are not used, particular attention must be applied to decontaminating boots thoroughly.
- If suit is heavily soiled, rinse it off. If disposable boot covers are used, they will be removed at this station.
- Remove outer gloves; inspect and discard if damaged. Leave inner gloves on. Personnel will remove their outer garment and gloves, dispose of them, and properly label container or drum. Personnel will then decontaminate their hard hats and boots with an aqueous solution of detergent or other appropriate cleaning solution. These items then will be hand-carried to the next station. Remove protective suit and then inner gloves.
- Thoroughly wash hands and face before leaving CRZ.

### **8.1.3 Sampling and Processing Equipment Decontamination**

To prevent sample cross-contamination, sampling, and processing equipment in contact with soil, sediment, biota, or water samples will undergo the following decontamination procedures when work is completed in the CRZ and prior to additional use:

1. Rinse with potable water and wash with scrub brush.
2. Scrub with phosphate-free detergent (Alconox®).
3. Visually inspect the sampler and repeat the scrub and rinse step, if necessary. If scrubbing and rinsing with Alconox® is insufficient to remove visually observable contamination on equipment, the equipment will be scrubbed and rinsed using hexane (or similar type solution) until all visual signs of contamination are absent.
4. Rinse external sampling equipment with potable water three times prior to use. Rinse homogenizing equipment once with potable water and three times with distilled water prior to and between sample processing.

### **8.1.4 Handling of Investigation-Derived Waste**

All remaining soil or sediment, fluids used for decontamination of sampling equipment, and sample collection disposable wastes (e.g., gloves, paper towels, foil, or others) will be placed into appropriate containers and staged on site for disposal.

#### **8.1.4.1 Disposable PPE**

Disposable PPE may include Tyvek suits, inner latex gloves, outer gloves, and disposable boot covers. Dispose of PPE according to the requirements of the client and state and federal agencies.

#### **8.1.4.2 Non-disposable PPE**

Non-disposable PPE includes items such as boots.

When decontaminating non-disposable PPE, observe the following practices and procedures:

- Decontaminate the PPE outside with a solution of detergent and water; rinse with water prior to leaving the site.

- Protect the PPE from exposure by covering with disposable covers such as plastic to minimize required decontamination activities.

### **8.1.5 Sanitizing of Personal Protective Equipment**

Reusable protective clothing and other personal articles must not only be decontaminated before being reused, but also sanitized. The insides of face shields and protective clothing become soiled due to exhalation, body oils, and perspiration. If practical, reusable protective clothing should be machine-washed after a thorough decontamination; otherwise, it must be cleaned by hand.

### **8.1.6 Emergency Personnel Decontamination**

Personnel with medical problems or injuries may also require decontamination. There is the possibility that the decontamination may aggravate or cause more serious health effects. If prompt lifesaving, first aid, and medical treatment are required, decontamination procedures will be omitted. In either case, a member of the site management team will accompany contaminated personnel to the medical facility to advise on matters involving decontamination.

### **8.1.7 Containment of Decontamination Fluids**

As necessary, spill control measures will be used to contain contaminated runoff that may enter into clean areas. Use plastic sheeting, hay bales, or install a spill control system to prevent spills and contain contaminated water.

### **8.1.8 Pressure Washing**

The following procedure is required when using high-pressure washing equipment for decontamination purposes:

- Wear modified Level D protection, including a face shield and safety goggles.
- Ensure that other personnel are out of the area prior to decontamination.
- Secure the area around the decontamination pad with cones, caution tape, or barricades.

- Ensure that safe work practices and precautions are taken to minimize the potential for physical injury from high-pressure water spray. Follow the manufacturer's operating instructions.
- The pressure washer wand must be equipped with a safety release handle.
- Ensure that the area is clean after equipment is decontaminated. Barricades, cones, or caution tape must be left in place and secured at all times.

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## **9 HEALTH AND SAFETY TRAINING AND INFORMATIONAL PROGRAMS**

This section describes the health and safety training and informational programs that Anchor QEA project site personnel must comply with.

### **9.1 Initial Project Site Orientation**

Work on all Anchor QEA project sites will require participation in an initial health and safety orientation presented by the PM or FL that will consist of, at a minimum, the following topics:

- A review of the contents of this HASP, including the anticipated Scope of Work and associated site hazards and control methods and procedures.
- Provisions of this plan are mandatory for all Anchor QEA personnel assigned to the project.
- Other contractors working at the Site are also expected to follow the provisions of this plan unless they have their own HASP that covers their specific activities related to this project and includes the minimum requirements of this HASP.
- All visitors to the work site will also be required to abide by the requirements of this plan.
- Personnel assigned to perform work at the project site, working under the provisions of this HASP, will be required to read the plan and must sign the Health and Safety Plan Acknowledgement Form to confirm that they understand and agree to abide by the provisions of this plan.

### **9.2 Daily Safety Meetings**

Daily safety meetings ("tailgate meetings") make accident prevention a top priority for everyone and reinforce awareness of important accident-prevention techniques. The following daily safety meeting procedures and practices are required:

- Daily safety meetings will be held each morning prior to conducting site activities.
- The daily safety meeting form in Appendix A will be used to document each meeting.
- Copies of the completed daily safety meeting forms will be maintained on-site during the course of the project.

### **9.3 Hazardous Waste Operations Training**

All personnel working on the Site shall be trained in accordance with the requirements of the 29 CFR 1910.120 (HAZWOPER) regulation. Training requirements will consist of the following:

- Field personnel must complete a minimum of 40 hours of hazardous waste activity instruction.
- Field personnel must complete a minimum of 3 days of supervised field instruction.
- Field personnel assigned to the site will also have received 8 hours of refresher training if time elapsed since their previous training has exceeded 1 year (i.e., refresher training is required annually).
- The PM and FL, or other staff directly responsible for employees engaged in hazardous waste operations, will receive an additional 8 hours of supervisory training.
- At a minimum, two people per field team shall be current in first aid/CPR and bloodborne pathogen training.

### **9.4 Hazard Communication Program**

The purpose of hazard communication (Employee Right-to-Know) is to ensure that the hazards of all chemicals located at the field project site are communicated to all Anchor QEA personnel and other contractors according to 29 CFR 1926.59.

Every container of hazardous materials must be labeled by the manufacturer, who must also provide a MSDS upon initial order of the product and upon request thereafter. The actual format may differ from company to company (e.g., National Fire Protection Association [NFPA], Hazardous Material Information System [HMIS], or other), but the labels must contain similar types of information. Maintain manufacturer labels if at all possible. The label may use words or symbols to communicate the following:

- The name of the chemical
- The name, address, and emergency telephone number of the company that made or imported the chemical
- The physical hazards (Will it explode or catch fire? Is it reactive? Is it radioactive?)
- Any important storage or handling instruction

- The health hazards (Is it toxic? Could it cause cancer? Is it an irritant? What is the target organ?)
- The basic protective clothing, equipment, and procedures that are recommended when working with the chemical

MSDS for all chemicals brought onto the site or anticipated to be encountered on site shall be provided in Appendix B of this HASP. These MSDS shall be readily available for reference by site personnel and emergency response personnel.

Hazardous materials received without proper labels shall be set aside and not distributed for use until properly labeled.

If a hazardous chemical is transferred into a portable container (approved safety can), even if it is for immediate use only, the contents of the portable container (for example, acetone, gasoline, etc.) must be identified.

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## **10 GENERAL PPE REQUIREMENTS**

The minimum level of PPE should be selected according to the hazards that may be encountered during site activities in accordance with established U.S. Environmental Protection Agency (EPA) levels of protection (D and Modified D). Only PPE that meets American National Standards Institute (ANSI) standards shall be worn. Workers must maintain proficiency in the use and care of PPE.

Refer to Section 5 of this plan for site-specific job task and level-of-protection requirements.

### **10.1 Minimum Requirements – Level D Protection**

The minimum level of protection on project sites will be Level D protection, which consists of the following equipment:

- Standard work uniform/coveralls
- Work boots with safety toe (meets ANSI Z41 – 1991 requirements for foot protection)
- Approved safety glasses or goggles (meets ANSI Z87.1 – 1989 requirements for eye protection)
- Hard hat if overhead or falling object hazards are present (meets ANSI Z89.1 – 1986 requirements for head protection)
- Traffic safety vest if working near heavy equipment or vehicular traffic
- Hearing protection when there are high noise levels

Level D protection will be used only when:

- The atmosphere contains no known hazards
- Work functions preclude splashes, immersions, or the potential for unexpected inhalation of, or contact with, hazardous concentrations of chemicals
- Atmospheric concentrations of contaminants are less than the Permissible Exposure Limit (PEL) and/or Threshold Limit Value (TLV)

Level D protection, without modification, may be appropriate for observation of construction activities where soils do not need to be handled and where work activities do not require



walking across contaminated materials. Level D would also be appropriate for handling sample coolers or other containers where contaminated materials are fully contained.

#### **10.1.1 Modified Level D Protection Requirements**

Level D protection shall be modified, as warranted by site conditions and tasks performed, to include additional protective equipment such as USCG-approved PFDs, face shields/goggles, chemical-resistant clothing, rain gear, and disposable gloves of varying materials depending on the chemical substances involved. Modified Level D protection is the baseline gear for many of the sampling activities described in this HASP.

### **10.2 Respiratory Protection Requirements**

Respiratory protection devices may potentially be used for protection against particulates and organic vapors during the course of an Anchor QEA field project. The need for respiratory protection will be determined by air monitoring results and site conditions. However, engineering and administrative controls must first be evaluated for use as the primary controls for protection against site respiratory hazards. In the event that engineering and administrative controls are deemed not feasible, respiratory protection will be required. As stated previously in this HASP, the use of respiratory protection is not anticipated. If significant concentrations of organic vapors are encountered, as discussed in Section 5, work will be suspended and this HASP will be modified, if necessary, to incorporate respiratory protection requirements.

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## **11 GENERAL AIR MONITORING REQUIREMENTS**

### **11.1 General Requirements**

As discussed in Section 5, air monitoring will be performed during initial sample collection activities as a precaution; although the results of previous investigations indicate that respiratory protection will not be required. Site-specific air monitoring action levels are provided in Section 5.2 of this HASP.

### **11.2 Real-Time Air Monitoring Equipment**

As applicable, organic vapor concentrations shall be monitored in the field with either a photoionization detector (PID) or flame ionization detector (FID). Flammable vapors and/or gasses are monitored with an oxygen/lower-explosive level (O<sub>2</sub>/LEL) real-time instrument. Organic vapor measurements are usually taken in the breathing zone of the worker while O<sub>2</sub>/LEL measurements are taken at the point of operation (e.g., monitoring well head or auger point).

As applicable, airborne dust/particulate concentrations shall be measured using a real-time aerosol monitor (using a scattered light photometric sensing cell) when there are visible signs of potentially contaminated airborne dust. Both area and personal air monitoring readings are to be taken to characterize site activities.

Air monitoring results shall be documented on the Daily Air Monitoring Record Form (see Appendix A) or in the field logbook.

### **11.3 Equipment Calibration and Maintenance**

Calibration and maintenance of air monitoring equipment shall follow manufacturer specifications and must be documented. Recalibration and adjustment of air monitoring equipment shall be completed as site conditions and equipment operation warrant. Record all air monitoring equipment calibration and adjustment information on a Daily Air Monitoring Record form and in the field logbook.

#### **11.4 Air Monitoring Action Levels**

Air monitoring action levels have been developed that stipulate the chemical concentrations in the breathing zone that require an upgrade in level of PPE.

Air monitoring action levels are typically set at one-half of the OSHA PEL, NIOSH Recommended Exposure Limit (REL), or the American Conference of Governmental Industrial Hygienists (ACGIH) TLVs. The rationale for establishing action levels is based on the available data that characterize COCs in site media.

Air monitoring measurements shall generally be taken in the breathing zone of the worker most likely to have the highest exposure. Transient peaks will not automatically trigger action. Action will be taken when levels are consistently exceeded in a 5-minute period. Similarly, if chemical odors are detected that are a nuisance, bothersome, or irritating, an upgrade in respiratory protection can provide an extra level of comfort or protection when conducting site activities.

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## **12 HEALTH AND SAFETY PROCEDURES AND PRACTICES**

In addition to the task-specific JSAs presented in Appendix C of this HASP, this section lists the health and safety procedures and practices applicable to this project. For additional information, consult with the PM.

### **12.1 Physical Hazards and Controls**

#### **12.1.1 General Site Activities**

Observe the following general procedures and practices to prevent physical hazards:

- Legible and understandable precautionary labels shall be affixed prominently to containers of potentially contaminated soil, sediment, water, and clothing.
- No food or beverages shall be present or consumed in areas that have the potential to contain COCs and/or contaminated materials or equipment.
- No tobacco products or cosmetics shall be present or used in areas that have the potential to contain COCs and/or contaminated materials or equipment.
- An emergency eyewash unit shall be located immediately adjacent to employees who handle hazardous or corrosive materials, including decontamination fluids. All operations involving the potential for eye injury or splash must have approved field eyewash units locally available.
- On a project-specific basis, personnel working on or near bodies of water shall wear USCG-approved PFDs.
- Generally, all on-site activities will be conducted during daylight hours. If work after dusk is planned or becomes necessary due to an emergency, adequate lighting must be provided.
- Hazardous work, such as handling hazardous materials and heavy loads and equipment operation, should not be conducted during severe storms.
- All temporary electrical power must have a ground fault circuit interrupter (GFCI) as part of its circuit if the circuit is not part of permanent wiring. All equipment must be suitable and approved for the class of hazard present.
- The PM or FL and appropriate personnel from other contractors will review site access routes and work locations for adequate clearance (overhead and laterally) slope, and ground stability prior to moving equipment on-site.

### **12.1.2 Slip/Trip/Fall**

Observe the following procedures and practices to prevent slips, trips, and falls:

- Inspect each work area for slip/trip/fall potential prior to each work task.
- Slip/trip/fall hazards identified must be communicated to all personnel. Hazards identified shall be corrected or labeled with warning signs to be avoided.
- All personnel must be aware of their surroundings and maintain constant communication with each other at all times.

### **12.1.3 Underground/Overhead Utility Line Contact Prevention**

Observe the following underground/overhead utility line contact prevention procedures and practices:

- Prior to conducting work, the PM or FL shall ensure that all existing underground or overhead utilities in the work area are located per the state or local mark-out methods, including identification of utility lines that may be submerged in waterways. Documentation of utility mark-out shall be completed using a Utility Contact Prevention Checklist form. No excavation work is to be performed until all utility mark-outs are verified.
- The PM or FL shall conduct a site survey to search for signs of other buried or overhead utilities. The results of such surveys shall be documented on the Utility Mark-out documentation form.
- The property owner or facility operator shall be consulted on the issue of underground utilities. As-built drawings shall be reviewed, when available, to verify that underground utility locations are consistent with the utility location mark-outs. All knowledge of past and present utilities must be evaluated prior to conducting work.
- If on-site subsurface utility locations are in question, a private locating service shall be contacted to verify locations. If the investigation calls for boreholes in an area not covered by the municipal One-Call system, then a private utility locate firm shall be contacted to determine the location of other underground utilities.
- The PM shall have documented verbal contact and an agreement with the fiber optic company for all work within 50 feet of any fiber optic cables.

- **Only hand digging is permitted within 3 feet of underground high voltage, product, or gas lines.** Once the line is exposed, heavy equipment can be used, but must remain at least 3 feet from the exposed line.
- Elevated superstructures (e.g., drill rig, backhoe, scaffolding, ladders, and cranes) shall remain a distance of 200 feet away from utility lines and 30 feet away from power lines. Distance from utility lines may be adjusted by the FL depending on actual voltage of the lines.
- Overhead utility locations shall be marked with warning tape or flags where equipment has the potential for contacting overhead utilities.

#### **12.1.4 Electric Shock**

Observe the following procedures and practices to prevent electric shock:

- Use GFCIs as required.
- Perform lockout/tagout (LO/TO) procedures in accordance with regulatory requirements, if applicable.
- Use three-pronged plugs and extension cords.
- Contact your local underground utility-locating service.
- Follow code requirements for electrical installations in hazardous locations.
- Always use qualified electricians to install electrical equipment and when conducting troubleshooting activities within 10 feet of exposed live wires.

#### **12.1.5 Hand and Power Tools**

Observe the following procedures and practices when working with hand and power tools:

- Keep hand tools sharp, clean, oiled, dressed, and not abused.
- Worn tools are dangerous. For example, the “teeth” in a pipe wrench can slip if worn smooth, an adjustable wrench will slip if the jaws are sprung, and hammerheads can fly off loose handles.
- Tools subject to impact (e.g., chisels, star drills, and caulking irons) tend to “mushroom.” Keep them dressed to avoid flying spalls. Use tool holders.
- Do not force tools beyond their capacity.

- Flying objects can result from operating almost any power tool, so always warn people in the vicinity and use proper eye protection.
- Each power tool should be examined before use for damaged parts, loose fittings, and frayed or cut electric cords. Tag and return defective tools for repairs. Also inspect for adequate lighting, proper lubrication, and abandoned tools or material that could “vibrate into trouble.”
- Compressed air must be shut off or the electric cord unplugged before making tool adjustments. Air must be “bled down” before replacement or disconnection.
- Proper guards or shields must be installed on all power tools before issue. Do not use improper tools or tools without guards in place.
- Replace all guards before start-up. Remove cranks, keys, or wrenches used in service work.

#### **12.1.6 Vehicular Traffic**

Observe the following procedures and practices regarding vehicular traffic:

- Wear a traffic safety vest when vehicle hazards exist.
- Use cones, flags, barricades, and caution tape to define the work area.
- Use a vehicle to block work area.
- Engage a police detail for high-traffic situations.
- Always use a spotter in tight or congested areas for material deliveries.
- As necessary, develop traffic control plans and train personnel as flaggers in accordance with the DOT MUTCD and/or local requirements.

See Section 7.4.2 for additional information regarding work in roadways.

#### **12.1.7 Boating Operations**

The following precautions shall be followed when conducting boating trailer and launch activities:

- Follow the trailer and boat manufacturers’ instructions for securing the boat to the trailer.

- Follow the trailer manufacturer's instructions for securing the trailer to the towing vehicle.
- Prohibit workers from moving into trailer/vehicle pinch points without advising the vehicle operator.
- Use experienced operators when backing trailers on boat ramps.
- Wear proper work gloves when the possibility of pinching or other injury may be caused by moving or handling large or heavy objects.
- Maintain all equipment in a safe condition.
- Launch boats one at a time to avoid collisions.
- Use a spotter for vehicles backing boats to the launch area.
- Understand and review hand signals.
- Wear boots with non-slip soles when launching boats.
- Wear USCG-approved PFDs when working on or near the water.
- Keep ropes and lines coiled and stowed to eliminate trip hazards.
- Maintain three-point contact on dock/pier or boat ladders.
- Ensure that drain plugs are in place, as present.

The following precautions shall be followed when conducting boating operations:

- Maintain a current boater's license(s) as required.
- Wear USCG-approved PFDs for work activities on or near the water.
- Provide a floating ring buoy with at least 90 feet of line in the immediate boat launch/landing areas.
- Step into the center of the boat (small boats only).
- Keep your weight low when moving on the boat (small boats only).
- Move slowly and deliberately.
- Steer directly across other boat wakes at a 90-degree angle to avoid capsizing.
- Steer the boat facing forward.
- Watch for floating objects in the water.
- Right-of-way is yielded to vessels on your boat's right, or starboard, and vessels with limited ability to maneuver such as any wind-propelled vessel.

The following precautions shall be followed when working on a boat:



- Observe proper lifting techniques.
- Obey lifting limits.
- Use mechanical lifting equipment (i.e., pulleys or winches) to move large or awkward loads.
- Wear USCG-approved PFDs for work activities on or near the water.

The safety-related items listed in Table 12-1 shall be available when conducting boating operations:

**Table 12-1**  
**Safety Equipment Specific to In-water Work**

<b>Additional Safety Equipment for Sampling Vessel per U.S. Coast Guard (USCG) Requirements:</b>	
<ul style="list-style-type: none"> <li>• Proper vessel registration, numbering, and documentation (registered with state, certificate of vessel registration number displayed, and carrying a valid certificate of number)</li> <li>• USCG-approved personal flotation devices (PFDs; or life jackets) for every person on the sampling vessel (Type II PFD required, Type I PFD preferred as it will turn most unconscious wearers face up in the water)</li> <li>• Appropriate, non-expired, visual distress devices for day and night use from the following: <ul style="list-style-type: none"> <li>- Three hand-held red flares (day and night), or</li> <li>- One hand-held red flare and two parachute flares (day and night), or</li> <li>- One hand-held orange smoke signal, two floating orange smoke signals (day), and one electric distress light (night only)</li> </ul> </li> <li>• Alternate means of propulsion (oars or paddles)</li> <li>• Dewatering device (pump or bailer)</li> <li>• Properly maintained and inspected USCG-approved fire extinguishers (no fixed system = (2) B-1 or (1) B-2 type extinguishers; fixed system = (1) B-1 type extinguisher)</li> <li>• Proper ventilation of gasoline-powered vessels</li> <li>• Sound-producing device (whistle, bell, or horn)</li> <li>• VHF 2-way radio or cellular telephone</li> <li>• Proper navigational light display</li> <li>• Throwable life ring with attached line (any vessel larger than 16 feet is required to carry one Type IV [throwable] PFD)</li> </ul>	
<b>Additional USCG Recommended Equipment Includes:</b>	
<ul style="list-style-type: none"> <li>• Extra visual distress signals</li> <li>• Primary and spare anchor</li> <li>• Heaving line</li> <li>• Fenders</li> <li>• First aid kit</li> <li>• Flashlight</li> <li>• Mirror</li> <li>• Searchlight</li> <li>• Sunburn lotion</li> <li>• Tool kit</li> <li>• Spare fuel</li> </ul>	<ul style="list-style-type: none"> <li>• Boat hook</li> <li>• Spare propeller</li> <li>• Mooring line</li> <li>• Food and water</li> <li>• Binoculars</li> <li>• Spare batteries</li> <li>• Sunglasses</li> <li>• Marine hardware</li> <li>• Extra clothing</li> <li>• Spare parts</li> <li>• Pertinent navigational chart(s) and compass</li> </ul>

### **12.1.8 Working Over or Near Water**

#### **12.1.8.1 Personal Flotation Devices**

Type III, Type V, or better USCG-approved PFD shall be provided and properly worn by all personnel in the following circumstances:

1. On floating pipelines, pontoons, rafts, or stages.
2. On structures extending over or next to the water, except where guard rails or safety nets are provided for employees.
3. Working alone at night where there are drowning hazards, regardless of other safeguards provided.
4. In skiffs, small boats, or launches, unless in an enclosed cabin or cockpit.
5. Whenever there is a drowning hazard.

The following precautions shall be followed when using PFDs:

- Prior to and after each use, the buoyant work vests or life preservers shall be inspected for defects that would alter their strength or buoyancy. Defective devices or devices with less than 13 pounds buoyancy shall be removed from service.
- All PFDs shall be equipped with reflective tape as specified in 46 CFR 25.25-15.
- Thirty-inch USCG-approved ring buoys with at least 150 feet of 600-pound capacity line shall be provided and readily available for emergency rescue operations. The distance between ring buoys shall not exceed 200 feet.
- PFD lights conforming to 46 CFR 161.012 shall be required whenever there is a potential need for life rings to be used after dark. On shore installations, at least one life ring, and every third one thereafter, shall have a PFD light attached. PFD lights on life rings are required only in locations where adequate general lighting (e.g., floodlights or light stanchions) is not provided.

### **12.1.9 Excavation and Trenching Activities**

#### **12.1.9.1 Definitions**

*Angle of Repose* – The greatest angle above the horizontal plane at which a material will lie without sliding.

*Benching* – A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels of steps, usually with vertical or near-vertical surfaces between levels.

*Competent Person* – An employee who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has the authority to take prompt corrective measures to eliminate them.

*Excavation* – Any man-made cut, cavity, trench, or depression in an earth surface, including its sides, walls, or faces, formed by earth removal.

*Registered Professional Engineer* – An individual currently registered as a P.E. (preferably civil) in the state where work is to be performed.

*Sheeting* – Members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

*Shield* – A structure that is able to withstand the forces imposed on it by a cave-in and thereby protects employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Shields may be pre-manufactured or job-built in accordance with CFR 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

*Shoring* – Structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and that is designed to prevent cave-ins.

*Sloping* – A method of protecting employees from cave-ins by excavating to form sides of a trench that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

*Support System* – A structure such as underpinning, bracing, or shoring, that provides support to an adjacent structure, underground installation, or the sides of an excavation.

*Trench* – A narrow (in relation to its length) excavation made below the surface of the ground. In general, the depth is greater than the width at the bottom, but the width of a trench at the bottom is not greater than 15 feet.

*Type A Soil* – Cohesive soils with an unconfined compressive strength of 1.5 tons per square foot (tsf) (144 kilopascal [kPa]) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam, and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, soil is NOT Type A if:

- The soil is fissured
- The soil is subject to vibration from heavy traffic, pile driving, or similar effects
- The soil has been previously disturbed
- The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of 4H:1V or greater
- The material is subjected to other factors that would require it to be classified as a less stable material

*Type B Soil* – This classification refers to:

- Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa), but less than 1.5 tsf (144 kPa)
- Granular, cohesionless soils including angular gravel (similar to crushed rock), silt, silt loam, sandy loam, and, in some cases, silty clay loam and sandy clay loam
- Previously disturbed soils except those that would otherwise be classified as Type C soil
- Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subjected to vibration
- Dry rock that is not stable
- Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than 4H:1V, but only if the material would otherwise be classified as Type B

*Type C Soil* – This classification refers to:

- Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less
- Granular soils including gravel, sand, and loamy sand
- Submerged soil or soil from which water is freely seeping
- Submerged rock that is not stable
- Material in a sloped, layered system where the layers dip into the excavation or a slope of 4H:1V or steeper

#### 12.1.9.2 *Pre-Excavation Requirements*

*Underground Installations* – Prior to opening an excavation, the estimated locations of underground utilities such as sewer, telephone, fuel, electric, water, or any other underground installations that may reasonably be expected to be encountered during the excavation work shall be determined.

The property owner and/or utility location service shall be contacted within the established pre-notification time, advised of the proposed work, and asked to delineate the location of all underground utilities. Employees should be careful to protect and preserve the utility markings until they are no longer required for safe excavation. At least 3 feet of clearance between any underground utility and the cutting edge or point of powered excavation equipment will be maintained until the precise location of the utility is determined. Initial excavation within this 3-foot area will be conducted manually.

*Surface Encumbrances* – All surface encumbrances (e.g., trees, poles, or boulders) that may create a hazard to employees shall be removed or supported.

*Vehicular Traffic* – Employees exposed to vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material. Traffic control devices (e.g., barricades, signs, cones, or flagpersons) shall be specified and used in accordance with regulations applicable to the roadway or area in which excavation activities are occurring.

### **12.1.9.3 Training**

Those who supervise the entry of personnel into an excavation, a "Competent Person," must have completed a training course that included instruction in:

- Types of hazards associated with excavation operations
- Safe work practices and techniques
- A review of applicable federal, state, and local regulations
- A review of this procedure

Employees who enter excavations are required to complete a site-specific training session to enable them to recognize unsafe conditions in and around the excavation. This training can be conducted during a tailgate safety meeting that emphasizes the specific excavation hazards that may be encountered.

Training documentation shall be maintained in the project files. As part of the standard employee supervision process, training shall be complemented with on-the-job instruction and reinforcement of accepted practices to the extent necessary to ensure compliance with this procedure and all other applicable regulations.

### **12.1.9.4 Excavation Work Practices**

*General* – Each employee working within an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with 29 CFR 1926 Subpart P, except when the excavation is made entirely in stable rock or when the excavation is less than 5 feet deep and examination of the ground by a competent person provides no indication of a potential cave-in. A competent person shall ensure that protective systems, when required, are installed and maintained per the design specifications. No employees shall be permitted to enter an excavation unless it is absolutely essential to do so and all requirements of this procedure are met.

*Supervision* – Work in an excavation shall be supervised at all times by a competent person. This individual will remain outside of the excavation at all times, and will be responsible for identifying any unusual developments aboveground that may warn of impending earth movement.

*Soil Classification* – Based on their training, the competent person will classify each soil or rock deposit as stable rock, Type A, Type B, or Type C. When layers of soil or rock exist, the weakest layer will be classified; however, each layer may be classified individually when a more stable layer lies under a less stable layer. If the properties or conditions of a soil or rock deposit change in any way, re-evaluation will be required.

*Access and Egress* – Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.

A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 or more feet in depth so as to require no more than 25 feet of lateral travel for employees.

*Protective Systems* – Protective systems shall be designed in accordance with 29 CFR 1926.652(b) or (c) and shall have the capacity to resist, without failure, all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

*Exposure to Falling Loads* – No employees shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded provided the vehicles are equipped with a cab shield and/or canopy adequate to protect the operator from shifting or falling materials.

*Warning System for Mobile Equipment* – When mobile equipment is operated adjacent to an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs.

*Hazardous Atmospheres* – Where an oxygen-deficient (less than 19.5% O<sub>2</sub>) or hazardous atmosphere exists, or could reasonably be expected to exist, the excavation shall be tested



before employees enter. Testing shall be conducted as often as necessary to ensure that the atmosphere remains safe. Some excavations may be considered confined spaces that require compliance with appropriate procedures. If entry into a confined space is required, work will be suspended until this HASP is amended to include appropriate procedures. Adequate precautions shall be taken to prevent employee exposure to oxygen-deficient or hazardous atmospheres.

*Water Accumulation Hazards* – Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. If water is controlled or prevented from accumulating by the use of water removal equipment, the process shall be monitored by a competent person to ensure proper operation.

If the excavation work interrupts the natural drainage of surface water (e.g., streams or run-off channels), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to run-off from heavy rains shall be regularly inspected by a competent person.

*Stability of Adjacent Structures* – Structures adjoining an excavation shall be evaluated to assess their stability. Excavation below the level of the base or footing of any foundation or retaining wall that could reasonably be expected to pose a hazard to employees shall only be permitted when:

- A support system (underpinning) is provided to ensure the safety of employees and the stability of the structure
- The excavation is in stable rock
- A registered P.E. has determined that the structure will be unaffected by the excavation
- A registered P.E. has determined that such excavation will not pose a hazard to employees

Sidewalks, pavements, and other surface structures shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

*Protection from Loose Rock or Soil* – Employees shall be protected from loose rock or soil that could fall or roll from the excavation face or edge. Such protection could consist of scaling to remove loose materials, or the installation of protective barriers. All spoil shall be placed at least 2 feet from the edge of the excavation. It is strongly recommended that spoil be placed 4 or more feet from the excavation edge so as not to cover surface indicators of subsidence (such as fissures or cracks).

*Inspections* – A competent person shall make daily inspections of excavations, adjacent areas, and protective systems for evidence of conditions that could result in a cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. The inspection shall be made prior to start of work, and as needed throughout the shift. Inspections shall be made after each rainstorm or other hazard-increasing event, and will be documented. Where the inspection finds evidence of any hazardous condition, exposed employees shall immediately be removed from the hazardous area until necessary precautions have been taken.

*Fall Protection* – Where employees or equipment are permitted to cross over excavations, walkways or bridges shall be provided. Standard guard rails shall be provided where walkways are 6 feet or more above lower levels. Adequate barriers or other types of physical protection shall be provided at all remotely located excavations. All wells, pits, or shafts, shall be barricaded or covered, and shall be backfilled as soon as possible.

#### **12.1.10 Noise**

Excessive noise is hazardous not only because of its potential to damage hearing, but also because of its potential to disrupt communications and instructions. The following procedures and practices shall be followed to prevent noise-related hazards:

- All employees will have access to disposal ear plugs with a Noise Reduction Rating of not less than 30.

- Ear plugs must be worn in any environment where workers must raise their voices to be heard while standing at a distance of 3 feet or less.
- Ear plugs must be worn by any personnel operating concrete cutting or sawing equipment.

#### **12.1.11 Lifting and Material Handling**

Observe the following procedures and practices for lifting and material handling:

- Use leather gloves when handling metal, wire rope, sharp debris, or transporting materials (e.g., wood, piping, drums, etc.). Chemically protective gloves must be worn in addition to leather gloves if contaminated materials are handled; leather gloves to not offer adequate protection from COCs with dermal exposure routes of concern.
- The size, shape, and weight of the object to be lifted must first be considered. No individual employee is permitted to lift any object that weighs over 60 pounds. Multiple employees or mechanical lifting devices are required for objects over the 60-pound limit.
- Plan a lift before doing it. Bend at the knees and lift with the legs; keep the natural curves of the back; do not use back muscles.
- Check the planned route for clearance.
- Use the buddy system when lifting heavy or awkward objects.
- Do not twist your body while lifting.
- Know the capacity of any handling device (e.g., crane, forklift, chain fall, or come-along) that you intend to use.
- Use tag lines to control loads.
- Ensure that your body, material, tools, and equipment are safe from such unexpected movement as falling, slipping, rolling, tripping, bowing, or any other uncontrolled motion.
- Trucks (i.e., flat beds) hauling equipment or materials must not be moved once rigging has been released.
- Chock all material and equipment (such as pipe, drums, tanks, reels, trailers, and wagons) as necessary to prevent rolling.
- Tie down all light, large-surface-area material that might be moved by the wind.

- When working at heights, secure tools, equipment, and wrenches against falling.
- Do not store materials or tools on ducts, lighting fixtures, beam flanges, hung ceilings, or similar elevated locations.
- Fuel-powered tools used inside buildings or enclosures shall be vented and checked for excessive noise.

#### **12.1.12 Fire Control**

Observe the following fire control procedures and practices:

- Smoke only in designated areas.
- Keep flammable liquids in closed containers.
- Keep the work site clean; avoid accumulating combustible debris such as paper.
- Obtain and follow property owner hot work safety procedures when welding or performing other activities requiring an open flame.
- Isolate flammable and combustible materials from ignition sources.
- Ensure fire safety integrity of equipment installations according to NEC specifications.

#### **12.1.13 Static Electricity and Transfer of Flammable Liquids**

Observe the following procedures and practices regarding static electricity when transferring flammable liquids:

- Electrically bond and ground pumps, transfer vessels, tanks, drums, bailers, and probes when moving flammable liquids.
- Electrically bond and ground vacuum trucks and the tanks they are emptying.
- Do not splash fill containers with flammable liquids.
- Pour flammable liquids slowly and carefully.
- Two fire extinguishers (2A20:BC) must be available, charged, inspected, and readily accessible.

#### **12.1.14 Cleaning Equipment**

Observe the following procedures and practices when cleaning equipment:

- Wear appropriate PPE to avoid skin and eye contact with isopropyl alcohol, Alconox®, or other cleaning materials.
- Stand upwind to minimize any potential inhalation exposure.
- Dispose of spent cleaning solutions and rinses accordingly.

## **12.2 Environmental Hazards and Controls**

### **12.2.1 Heat Stress**

Observe the following general procedures and practices regarding heat stress:

- Increase the number of rest breaks and/or rotate workers in shorter work shifts.
- Watch for signs and symptoms of heat stress and fatigue (see Section 12.2.1.1).
- During hot months, plan work for early morning or evening.
- Use ice vests when necessary.
- Rest in cool, dry areas.

#### **12.2.1.1 Signs, Symptoms, and Treatment**

Adverse climatic conditions are important considerations in planning and conducting site operations. High ambient temperature can result in health effects ranging from transient heat fatigue, physical discomfort, reduced efficiency, personal illness, and increased accident probability to serious illness or death. Heat stress is of particular concern when chemical protective garments are worn since they prevent evaporative body cooling. Wearing PPE places employees at considerable risk of developing heat stress.

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of the most common (and potentially serious) illnesses, regular monitoring and other preventive precautions are vital.

**Heat Rash.** Heat rash can be caused by continuous exposure to hot and humid air and skin abrasion from sweat-soaked clothing. The condition is characterized by a localized red skin rash and reduced sweating. Heat rash reduces the ability to tolerate heat. To treat, keep skin hygienically clean and allow it to dry thoroughly after using chemical protective clothing.

**Heat Cramps.** Heat cramps are caused by profuse perspiration with inadequate electrolytic fluid replacement. This often robs the larger muscle groups (stomach and quadriceps) of blood, which can cause painful muscle spasms and pain in the extremities and abdomen. To treat, remove the employee to a cool place and give sips of water or an electrolytic drink. Watch for signs of heat exhaustion or heat stroke.

**Heat Exhaustion.** Heat exhaustion is a mild form of shock caused by increased stress on various organs to meet increased demand to cool the body. Onset is gradual and symptoms should subside within 1 hour. Symptoms include a weak pulse; shallow breathing; pale, cool, moist skin; profuse sweating; dizziness; and fatigue. To treat, remove the employee to a cool place and remove as much clothing as possible. Give sips of water or electrolytic solution and fan the person continuously to remove heat by convection. Do not allow the affected person to become chilled. Treat for shock if necessary.

**Heat Stroke.** Heat stroke is the most severe form of heat stress; the body must be cooled immediately to prevent severe injury and/or death. ***This is a medical emergency!*** Symptoms include red, hot, dry skin; a body temperature of 105° F or higher; no perspiration; nausea; dizziness and confusion; and a strong, rapid pulse. Since heat stroke is a true medical emergency, transport the patient to a medical facility immediately. Prior to transport, remove as much clothing as possible and wrap the patient in a sheet soaked with water. Fan the patient vigorously while transporting to help reduce body temperature. If available, apply cold packs under the arms, around the neck, or any other place where they can cool large surface blood vessels. If transportation to a medical facility is delayed, reduce body temperature by immersing the patient in a cool-water bath (however, be careful not to over-chill the patient once body temperature is reduced below 102° F). If this is not possible, keep the patient wrapped in a sheet and continuously douse with water and fan.

#### 12.2.1.2 Prevention

The implementation of preventative measures is the most effective way to limit the effects of heat-related illnesses. During periods of high heat, adequate liquids must be provided to replace lost body fluids. Replacement fluids can be a 0.1% saltwater solution, a commercial mix such as Gatorade, or a combination of these with fresh water. The replacement fluid

temperature should be kept cool, 50° F to 60° F, and should be placed close to the work area. Employees must be encouraged to drink more than the amount required to satisfy thirst. Employees should also be encouraged to salt their foods more heavily during hot times of the year.

Cooling devices such as vortex tubes or cooling vests can be worn beneath impermeable clothing. If cooling devices are worn, only physiological monitoring will be used to determine work activity.

All workers are to rest when any symptoms of heat stress are noticed. Rest breaks are to be taken in a cool, shaded rest area. Employees shall remove chemical protective garments during rest periods and will not be assigned other tasks.

All employees shall be informed of the importance of adequate rest and proper diet, including the harmful effects of excessive alcohol and caffeine consumption.

#### **12.2.1.3      Monitoring**

Heat stress monitoring should be performed when employees are working in environments exceeding 90° F ambient air temperature. If employees are wearing impermeable clothing, this monitoring should begin at 77° F. There are two general types of monitoring that the health and safety representative can designate to be used: wet bulb globe temperature (WBGT), and physiological. A Heat Stress Monitoring Record form will be used to record the results of heat stress monitoring.

**Wet Bulb Globe Temperature (WBGT).** The WBGT index is the simplest and most suitable technique to measure the environmental factors that most nearly correlate with core body temperature and other physiological responses to heat. When WBGT exceeds 25° C (77° F), the work regimen in Table 12-2 should be followed.

**Table 12-2**  
**Permissible Heat Exposure Threshold Limit Values**

Work/Rest Regimen	Workload		
	Light	Moderate	Heavy
Continuous work	86° F (30.0° C)	80° F (26.7° C)	77° F (25.0° C)
75% work, 25% rest each hour	87° F (30.6° C)	82° F (28.0° C)	78° F (25.9° C)
50% work, 50% rest, each hour	89° F (31.4° C)	85° F (29.4° C)	82° F (27.9° C)
25% work, 75% rest, each hour	90° F (32.2° C)	88° F (31.1° C)	86° F (30.0° C)
These TLVs are based on the assumption that nearly all acclimated, fully-clothed workers with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 100.4° F (38° C).			

(From OSHA Technical Manual, Section III: Chapter 4 - Heat Stress)

The TLVs denoted in Table 12-2 apply to physically fit and acclimatized individuals wearing light, summer clothing. If heavier clothing that impedes sweat or has a higher insulation value is required, the permissible heat exposure TLVs should be adjusted based on the WBGT Correction Factors in Table 12-3.

**Table 12-3**  
**WBGT Correction Factors**

Clothing Type	WBGT Correction
Summer lightweight working clothing	32° F (0° C)
Cotton coveralls	28° F (-2° C)
Winter work clothing	25° F (-4° C)
Water barrier, permeable	86° F (-6° C)
Fully encapsulating	14° F (-10° C)

**Physiological.** Physiological monitoring can be used in lieu of, or in addition to, WBGT. This monitoring can be self-performed once the health and safety representative demonstrates appropriate techniques to affected employees. Since individuals vary in their susceptibility to heat, this type of monitoring has its advantages. The two parameters that are to be monitored at the beginning of each rest period are:



- **Heart Rate** – The maximum heart rate (MHR) is the amount of work (beats) per minute a healthy person's heart can be expected to safely deliver. Each individual will count his/her radial (wrist) pulse for 1 minute as early as possible during each rest period. If the heart rate of any individual exceeds 75% of their calculated MHR ( $MHR = 200 - \text{age}$ ) at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same. An individual is not permitted to return to work until his/her sustained heart rate is below 75% of their calculated MHR.
- **Temperature** – Each individual will measure his/her temperature with a thermometer for 1 minute as early as possible in the first rest period. If the temperature exceeds 99.6° F at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same. An individual is not permitted to return to work if his/her temperature exceeds 100.4° F

#### **12.2.1.4 Training**

Employees potentially exposed to heat stress conditions will be instructed on the contents of this procedure. This training can be conducted during daily tailgate safety meetings.

#### **12.2.2 Cold Stress**

Observe the following procedures and practices regarding cold stress:

- Take breaks in heated shelters when working in extremely cold temperatures.
- Upon entering the shelter, remove the outer layer of clothing and loosen other layers to promote evaporation of perspiration.
- Drink warm liquids to reduce the susceptibility to cold stress.
- Be aware of cold stress symptoms, including shivering, numbness in the extremities, and sluggishness.
- Provide adequate insulating dry clothing to maintain warmth if work is performed in air temperature below 40° F. Wind chill cooling rates and the cooling power of air are critical factors. The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.
- If the air temperature is 32° F or less, hands should be protected.

- If only light work is involved and if the clothing on the worker may become wet on the job site, the outer layer of the clothing in use should be impermeable to water. With more severe work under such conditions, the outer layer should be water repellent, and the outer wear should be changed as it becomes wetted. The outer garments should include provisions for easy ventilation in order to prevent wetting of the inner layer by sweat.
- If available clothing does not give adequate protection to prevent cold injury, work should be modified or suspended until adequate clothing is made available, or until weather conditions improve.
- Implement a buddy system in which workers are responsible for observing fellow workers for early signs and symptoms of cold stress.

#### *12.2.2.1 Signs, Symptoms, and Treatment*

Cold stress can range from frostbite to hypothermia. The signs and symptoms of cold stress are listed below. The appropriate guidelines should be followed if any personnel exhibit these symptoms:

**Frostbite.** Frostbite is characterized by pain in the extremities and loss of manual dexterity. "Frostnip," or reddening of the tissue, is accompanied by a tingling or loss of sensation in the extremities and continuous shivering.

**Hypothermia.** Hypothermia is characterized by pain in the extremities and loss of manual dexterity, with severe, uncontrollable shivering, and an inability to maintain the level of activity. Symptoms include excessive fatigue, drowsiness, irritability, or euphoria. Severe hypothermia includes clouded consciousness, low blood pressure, pupil dilation, cessation of shivering, unconsciousness, and possible death.

Remove the patient to a warm, dry place. If the patient's clothing is wet, remove it and replace it with dry clothing. Keep the patient warm. Re-warming of the patient should be gradual to avoid stroke symptoms. Dehydration, or the loss of body fluids, may result in a cold injury due to a significant change in blood flow to the extremities. If the patient is conscious and alert, warm sweet liquids should be provided. Coffee and other caffeinated

liquids should be avoided because of diuretic and circulatory effects. Extremities affected by frostbite should be gradually warmed up and returned to normal temperature. Moist compresses should be applied; begin with lukewarm compresses and slowly increase the temperature as changes in skin temperature are detected. Keep the patient warm and calm and remove them to a medical facility as soon as possible.

### **12.2.3 Inclement Weather**

Observe the following procedures and practices regarding inclement weather:

- Stop outdoor work during electrical storms (lightning strikes), hailstorms, high winds, and other extreme weather conditions such as extreme heat or cold
- Take cover indoors or in a vehicle
- Listen to local forecasts for warnings about specific weather hazards such as tornadoes, hurricanes, and flash floods



### **12.2.4 Insects/Spiders**

Observe the following general procedures and practices regarding insects/spiders:

- Tuck pants into socks
- Wear long sleeves
- Use insect repellent
- Avoid contact by always looking ahead to where you will be walking, standing, sitting, leaning, grabbing, lifting, or reaching
- Check for signs of insect/spider bites, such as redness, swelling, and flu-like symptoms

The most dangerous spiders to humans in North America are black widows and brown spiders (also known as brown recluse or fiddleback spiders). A guide to identifying these spiders is presented in Table 12-4.

**Table 12-4**  
**North American Hazardous Spider Identification Guide**

<b>Hazardous Spider Identification Guide</b>	
<p><b>Black Widow Spider</b></p> <ul style="list-style-type: none"> <li>• Abdomen usually shows hourglass marking.</li> <li>• Female is 3 to 4 centimeters in diameter.</li> <li>• Have been found in well casings and flush-mount covers.</li> <li>• Not aggressive, but more likely to bite if guarding eggs.</li> <li>• Light, local swelling and reddening are early signs of a bite, followed by intense muscular pain, rigidity of the abdomen and legs, difficulty breathing, and nausea.</li> <li>• If bitten, see a physician as soon as possible.</li> </ul>	
<p><b>Brown Spiders (aka Brown Recluse or Fiddleback)</b></p> <ul style="list-style-type: none"> <li>• Found in the central and southern United States, although in some other areas, as well.</li> <li>• 1/4-to-1/2-inch-long body and size of a silver dollar.</li> <li>• Hide in baseboards, ceiling cracks, and undisturbed piles of material.</li> <li>• Bite may either go unnoticed or may be followed by a severe localized reaction, including scabbing, necrosis of the affected tissue, and very slow healing.</li> <li>• If bitten, see a physician as soon as possible.</li> </ul>	

### **12.2.5 Bees and Wasps**

Many encounters with bees and wasps occur when nests built in well casings or excavation areas are disturbed. Before opening a well casing, take a few moments to observe whether or not insects are entering or exiting. If they are flying to and from the casing, avoid it if possible. If you must be in an area where disturbing a nest is likely, be sure to wear long pants and a long-sleeved shirt. Stinging insects fly around the top of their target, so if you get into trouble, pull a portion of your shirt over your head and run away.

If you get stung, look for a stinger, and, if present, remove it as soon as possible. Several over-the-counter products or a simple cold compress can be used to alleviate the pain of the

sting. If the sting is followed by severe symptoms, or if it occurs in the neck or the mouth, seek medical attention immediately because swelling could cause suffocation.

If you need to destroy a nest, consult with the PM and project FL first. Commercially available stinging insect control aerosols are very effective, but could potentially contaminate the well. Once the nest is destroyed, fine mesh may be applied over the exit and entry points of a well casing to prevent re-infestation.

### **12.2.6 Ticks**

Ticks in North America can be carriers of several diseases, including Lyme's Disease, Rocky Mountain Spotted Fever, and ehrlichiosis.

Limiting exposure to ticks reduces the likelihood of infection when exposed to tick-infested habitats. Measures to prevent tick exposure include the following:

- Remove leaf litter and brush in areas where you will be working prior to tick season.
- Wear light-colored clothing so that ticks are visible.
- Tuck your pant legs into your socks.
- Apply repellents to discourage tick attachment.
- Promptly inspect your body and remove crawling or attached ticks when you leave a tick-infested area.
- Conduct tick checks on buddies upon exiting any suspect area (may be needed multiple times per work day).
- Be aware of seasonal activity; ticks are often most active in the spring.

Observe the following procedures and practices if you are bitten by a tick:

- Use fine-tipped tweezers or shield your fingers with tissue, paper towel, or rubber gloves.
- Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause mouthparts to break off and remain in the skin.
- Do not squeeze, crush, or puncture the body of the tick because its fluids may contain infectious organisms.

- Do not handle the tick with bare hands because infectious agents may enter through mucous membranes or breaks in the skin.
- After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.
- You may wish to save the tick for identification in case you become ill within 2 to 3 weeks. Place the tick in a sealed plastic bag in the freezer, and mark the bag with the date of the bite.

### **12.2.7 Mosquitoes**

Mosquitoes in the United States have been known to carry West Nile Virus, St. Louis encephalitis, and Dengue Fever. To avoid mosquito bites:

- Apply insect repellent containing DEET (N,N-diethyl-meta-toluamide) when outdoors. DEET is very effective, but could potentially contaminate samples.
- Read and follow the product directions whenever you use insect repellent.
- Wear long-sleeved clothes and long pants treated with repellent to further reduce your risk, or stay indoors during peak mosquito feeding hours (dusk until dawn).
- Limit the number of places available for mosquitoes to lay their eggs by eliminating standing water sources from around the work area.
- If you need to destroy a nest, consult with the PM and project FL first.
- Check to see if there is an organized mosquito control program near the project site. If no program exists, work with the local government officials to establish a program.

### **12.2.8 Poisonous Snakes**

Observe the following procedures and practices regarding poisonous snakes:

- Avoid walking in areas where snakes may nest or hide. When walking, always look ahead for signs of snakes.
- Use extreme caution when moving or lifting objects that could be used by snakes as cover.
- Never reach under or behind objects or into other areas where snakes may hide.
- Wear sturdy leather boots.

- Poisonous snakebites are medical emergencies. If bitten by any type of snake, immediately seek medical attention.

### **12.2.9 Waterborne Pathogens**

A potentially life-threatening bacterium, *Vibrio vulnificus*, occurs naturally in estuarine and marine waters and in associated filter-feeding shellfish, such as oysters and mussels. The organism is able to cause infection through ingestion or through a wound. *Vibrio vulnificus* is common in Texas coastal waters from May to September (when waters are the warmest). Most healthy people are resistant to infection with this bacterium. Those who are at risk are persons with underlying diseases (especially liver diseases), blood disorders, diabetes, cancer, or any condition that affects the immune system. Persons considered to be at risk for bacterial infections should not perform field tasks associated with this project.

The symptoms of developing a *Vibrio vulnificus* infection include, but may not be limited to:

- Fever and chills
- Redness and swelling of affected area
- Pain
- Decreased blood pressure
- Tissue destruction at the site of the wound

Persons developing a *Vibrio vulnificus* infection require immediate medical attention including antibiotics, and potentially the removal of affected tissue or limbs. To reduce the possibility of *Vibrio vulnificus* or any other infection during field activities, care shall be taken not to allow any exposure of cuts or abrasions to the waters of the project area or the equipment or samples that have been in contact with the waters. Any cuts or abrasions that occur while performing the sampling activities shall be immediately treated with a topical antibacterial agent and bandaged. Should the affected area exhibit redness, swelling, or any other abnormal symptom, immediate medical attention should be sought.

Potential parasitic hazards may be present in surface waters, sediment, and soil. These include, but are not limited to: roundworm, whipworm, and hookworm. People can become infected with intestinal worms through contact with soil that has been contaminated with

human or animal feces. Parasites can enter the body through ingestion as well as dermal contact. Hookworm larvae, which may be present in animal feces (including nutria [*Myocastor coypus*] feces), can burrow through skin. Intestinal parasites can cause symptoms such as:

- Diarrhea
- Abdominal cramps
- Loss of appetite
- Distended abdomen
- Coughing, fever, and vomiting

Anyone experiencing these or any abnormal symptoms should seek medical attention. To reduce the potential for exposure to parasites, skin contact with water and sediment/soil will be avoided through the use of rubber gloves or any other appropriate PPE.







#### **12.2.10 Poisonous Plants**

Poisonous plants include poison ivy, poison oak, and poison sumac as shown in Table 12-5. Observe the following procedures and practices regarding poisonous plants:

- Avoid entering areas infested with poisonous plants.
- Immediately wash any areas that come into contact with poisonous plants.
- Use PPE when there is a possibility of contact with poisonous plants.



**Table 12-5**  
**Hazardous Plant Identification Guide**

Hazardous Plant Identification Guide		
<b>Poison Ivy</b> <ul style="list-style-type: none"> <li>• Grows in West, Midwest, Texas, and the East Coast</li> <li>• Several forms—vine, trailing shrub, or shrub</li> <li>• Three leaflets (can vary from 3 to 9)</li> <li>• Leaves are green in summer, and red in fall</li> <li>• Yellow or green flowers</li> <li>• White berries</li> </ul>		
<b>Poison Oak</b> <ul style="list-style-type: none"> <li>• Grows in the East (New Jersey to Texas) and Pacific Coast</li> <li>• 6-foot tall shrubs or long vines</li> <li>• Oak-like leaves in clusters of three</li> <li>• Yellow berries</li> </ul>		
<b>Poison Sumac</b> <ul style="list-style-type: none"> <li>• Grows in boggy areas, especially in the Southwest and Northern states</li> <li>• Shrub up to 15 feet tall</li> <li>• Seven to 13 smooth-edged leaflets</li> <li>• Glossy pale yellow or cream-colored berries</li> </ul>		

If you have been exposed to poison ivy, oak, or sumac, act quickly because the toxin in the plants penetrates the skin within minutes. If possible, stay outdoors until you complete the first two steps:

1. Cleanse the exposed skin with generous amounts of isopropyl alcohol.
2. Wash the skin with water.
3. Take a regular shower with soap and warm water. Do not use soap until this point because it will pick up the toxin from the surface and move it around.
4. Wash clothes, tools, and anything else that may have been in contact with the toxin, with alcohol and water. Be sure to wear hand protection during that process.

Signs and symptoms of exposure include redness and swelling that appears 12 to 48 hours after exposure. Blistering and itching will follow. If you have had a severe reaction in the past, you should see a physician right away. Over-the-counter products that are available to alleviate symptoms include Cortaid®, Lanacort®, baking soda, Aveeno® oatmeal baths, and calamine lotion.

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## 13 MEDICAL SURVEILLANCE PROGRAM

This section describes the medical surveillance program that Anchor QEA field personnel must comply with when working on sites where there is a potential for exposure to hazardous wastes or other hazardous substances.

### 13.1 General Requirements

Anchor QEA employees shall be enrolled in a medical surveillance program in compliance with OSHA standards (29 CFR 1910.120(f)) under the following circumstances:

If they are involved with any of the following operations:

- *Cleanup operations* required by a governmental body, whether federal, state, local, or other involving hazardous substances that are conducted at uncontrolled hazardous waste sites (including, but not limited to, the EPA's National Priority List [NPL] sites, state priority list sites, sites recommended for the EPA NPL, and initial investigation of government-identified sites that are conducted before the presence or absence of hazardous substances has been ascertained).
- *Corrective actions* involving cleanup operations at sites covered by the Resource Conservation and Recovery Act of 1976 (RCRA) as amended (42 U.S.C. 6901 et seq).
- *Voluntary cleanup operations* at sites recognized by federal, state, local, or other governmental bodies as uncontrolled hazardous waste sites.
- *Operations involving hazardous wastes* that are conducted at treatment, storage, and disposal (TSD) facilities regulated by 40 CFR Parts 264 and 265 pursuant to RCRA or by agencies under agreement with the EPA to implement RCRA regulations.
- *Emergency response operations* for releases of, or substantial threats of releases of, hazardous substances without regard to the location of the hazard.

And, if the employee(s) meets the following criteria:

- Are or may be exposed to hazardous substances or health hazards at or above the established PEL, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more per year.

In addition, employees are required to be enrolled in the medical surveillance program if they meet any of the following conditions:

- Wear a respirator for 30 days or more per year
- Are injured, become ill, or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operations
- Are members of a Hazardous Materials (HAZMAT) team

Anchor QEA employees required to be enrolled in a medical surveillance program under 29 CFR 1910.120(f) shall have medical examinations and consultations made available to them by Anchor QEA on the following schedule:

- Prior to assignment
- At least once every 12 months unless the attending physician believes a longer interval (not greater than biennially) is appropriate
- At termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last 6 months
- As soon as possible upon notification that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that the employee has been injured or exposed above the PEL or published exposure levels in an emergency situation
- At more frequent times, if the examining physician determines that an increased frequency of examination is medically necessary

The content of medical examinations or consultations made available to employees shall be determined by the attending physician but shall include, at a minimum, a medical and work history with special emphasis on symptoms related to the handling of hazardous substances and health hazards, and to fitness for duty including the ability to wear any required PPE under conditions (i.e., temperature extremes) that may be expected at the work site.

The attending physician shall provide Anchor QEA with a written opinion for each examined employee that contains the following information:

- Whether the employee has any detected medical conditions that would place the employee at an increased risk of impairment of the employee's health from hazardous waste operations work, emergency response, or respirator use
- Any recommended limitations on the employee's assigned work
- A statement that the employee has been informed of the results of the medical examination and any medical conditions that require further examination or treatment

The written opinion obtained by Anchor QEA shall not reveal specific findings or diagnoses unrelated to occupational exposures. Medical surveillance and other employee-related medical records shall be retained for at least the duration of employment plus 30 years.

### **13.2 Crew Self Monitoring**

All personnel will be instructed to look for and inform each other of any deleterious changes in their physical or mental condition during the performance of all field activities. Examples of such changes are as follows:

- Headaches
- Dizziness
- Nausea
- Blurred vision
- Cramps
- Irritation of eyes, skin, or respiratory system
- Changes in complexion or skin color
- Changes in apparent motor coordination
- Increased frequency of minor mistakes
- Excessive salivation or changes in papillary response
- Changes in speech ability or speech pattern
- Symptoms of heat stress or heat exhaustion
- Symptoms of hypothermia

If any of these conditions develop, the affected person will be moved from the immediate work location and evaluated. If further assistance is needed, personnel at the local hospital

will be notified, and an ambulance will be summoned if the condition is thought to be serious. If the condition is the result of sample collection or processing activities, procedures and/or PPE will be modified to address the problem.

APPENDIX A  
HEALTH AND SAFETY LOGS AND FORMS

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DATE: \_\_\_\_\_

PROJECT NAME: \_\_\_\_\_

PROJECT NO: \_\_\_\_\_

## DAILY SAFETY BRIEFING

PERSON CONDUCTING  
MEETING: \_\_\_\_\_

HEALTH & SAFETY  
OFFICER: \_\_\_\_\_

PROJECT  
MANAGER: \_\_\_\_\_

### TOPICS COVERED:

- |  |   |   |
|--|---|---|
| <input type="checkbox"/> Emergency Procedures and Evacuation Route | <input type="checkbox"/> Lines of Authority                         | <input type="checkbox"/> Lifting Techniques             |
| <input type="checkbox"/> Directions to Hospital                    | <input type="checkbox"/> Communication                              | <input type="checkbox"/> Slips, Trips, and Falls        |
| <input type="checkbox"/> HASP Review and Location                  | <input type="checkbox"/> Site Security                              | <input type="checkbox"/> Hazard Exposure Routes         |
| <input type="checkbox"/> Safety Equipment Location                 | <input type="checkbox"/> Vessel Safety Protocols                    | <input type="checkbox"/> Heat and Cold Stress           |
| <input type="checkbox"/> Proper Safety Equipment Use               | <input type="checkbox"/> Work Zones                                 | <input type="checkbox"/> Overhead and Underfoot Hazards |
| <input type="checkbox"/> Employee Right-to-Know/MSDS Location      | <input type="checkbox"/> Vehicle Safety and Driving/Road Conditions | <input type="checkbox"/> Chemical Hazards               |
| <input type="checkbox"/> Fire Extinguisher Location                | <input type="checkbox"/> Equipment Safety and Operation             | <input type="checkbox"/> Flammable Hazards              |
| <input type="checkbox"/> Eye Wash Station Location                 | <input type="checkbox"/> Proper Use of PPE                          | <input type="checkbox"/> Biological Hazards             |
| <input type="checkbox"/> Buddy System                              | <input type="checkbox"/> Decontamination Procedures                 | <input type="checkbox"/> Eating/Drinking/Smoking        |
| <input type="checkbox"/> Self and Coworker Monitoring              | <input type="checkbox"/> Other:                                     |   |

WEATHER CONDITIONS: \_\_\_\_\_

DAILY WORK SCOPE: \_\_\_\_\_

SITE-SPECIFIC HAZARDS: \_\_\_\_\_

SAFETY COMMENTS: \_\_\_\_\_

### ATTENDEES

PRINTED NAME

SIGNATURE





## MODIFICATION TO HEALTH AND SAFETY PLAN

DATE \_\_/\_\_/\_\_

Project: \_\_\_\_\_

Modification:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Reasons for Modification:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Site Personnel Briefed:

Name: _____	Date: _____
Name: _____	Date: _____
Name: _____	Date: _____
Name: _____	Date: _____
Name: _____	Date: _____
Name: _____	Date: _____
Name: _____	Date: _____
Name: _____	Date: _____

Approvals:

Site Supervisor: \_\_\_\_\_

Site Safety and Health Officer: \_\_\_\_\_

CERCLA Project Coordinator: \_\_\_\_\_

President: \_\_\_\_\_

Other: \_\_\_\_\_

[illegible]

[illegible]



## UTILITY MARK-OUT DOCUMENTATION

Project Name: \_\_\_\_\_ Location: \_\_\_\_\_  
Task/Activity: \_\_\_\_\_ Date: \_\_\_\_\_  
Utility Called: \_\_\_\_\_ Confirmation #: \_\_\_\_\_  
County of work: \_\_\_\_\_ Municipality of work: \_\_\_\_\_

Before work is done on any site, contact the appropriate local utility locating service (One Call, Miss Dig, Uloco, etc.) or a local utility contractor to have sub grade utilities marked. NOTE: Boring locations to be placed not in the public right of way are typically not marked out by the public utility mark-out, and a private utility locate service must be engaged. Indicate to the utility locator the nearest intersecting street for the site: \_\_\_\_\_

Confirmation No: \_\_\_\_\_

List utility firms (public and private) and the utility they will mark.

Utility Marker Emergency Telephone Numbers			
Major Utilities Marked by Color Code			
Name of Utility Company	Utility	Color Code	Emergency Telephone Number
	Water	Blue	
	Gas	Yellow	
	Electric	Red	
	Telephone/Cable/ Communication	Orange	
	Sewer	Green	

"ALL UNDERGROUND UTILITIES MAY NOT BE LOCATED BY THE LOCAL UTILITY SERVICE."  
Accordingly, you must list other known utilities in the area that the "One Call" service will not contact:

Attach photos of the area prior to placing boreholes.

Take photos of the area indicating minimum 5 feet hand dig, post hole dig, probe, GPR, or other.

NOTE: For any borehole, should 5 feet minimum clearance not be obtained, you must contact Business Line VP or equivalent (Operations Director or other on the Federal Business Line) and obtain a variance.

Completed by:

\_\_\_\_\_  
Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

APPENDIX B  
MATERIAL SAFETY DATA SHEETS (MSDS)

---

Close

# Material Safety Data Sheet

ULTRA Scientific · 250 Smith Street · North Kingstown, RI, USA 02852 · 401-294-9400

Product # RPE-044A

Last Updated: 11/14/2006

## Section I Product Identification

**Name:** 1,2,3,4,6,7,8-Heptachlorodibenzofuran**Matrix:** neat compound

## Section II Composition / Information on Ingredients

Component	CAS #	% by Wt.	LD50	OSHA PEL	ACGIH TLV	RTECS #	Codes
1,2,3,4,6,7,8-heptachlorodibenzofuran	067562-39-4	100	N/A	N/A	N/A	N/A	G

**Codes:** A-OSHA regulated carcinogen; B-IARC Group 1 carcinogen; C-IARC Group 2A carcinogen; D-IARC Group 2B carcinogen; E-NTP Group 1 carcinogen; F-NTP Group 2 carcinogen; G-SARA Title III compound; H-California Proposition 65 compound.

## Section III Hazards Identification

Contains carcinogen(s) or cancer suspect agent(s)

All chemicals should be considered hazardous - direct physical contact should be avoided.

## Section IV First Aid Measures

**Inhalation:** If inhaled, remove to fresh air. Give oxygen, if necessary. Contact a physician.**Skin Contact:** In case of skin contact, flush with copious amounts of water. Remove contaminated clothing. Contact a physician.**Eye Contact:** In case of eye contact, flush with copious amounts of water, lifting eyelids occasionally. Contact a physician.**Ingestion:** If ingested, contact poison center immediately for recommended procedure. Contact a physician.

## Section V Fire Fighting Measures

**Fire and Explosion Hazard Data for Compound****Fire Hazard:** N/A**Extinguishing Media:** Carbon dioxide, dry chemical powder, or water spray.

## Section VI Accidental Release Measures

Ventilate area of the leak or spill. Wear appropriate personal protective equipment as specified in Section VIII. A leaking bottle, vial, or ampule may be placed in a plastic bag, and normal disposal procedures followed. Take up spilled material with sand or other non-combustible absorbant material, and place in an appropriate container for later disposal. Flush spill area with water.

## Section VII Handling and Storage

May be stored at room temperature

Keep in a tightly closed container, and store in a corrosion proof area.

This product should only be used by persons trained in the safe handling of hazardous chemicals.

### **Section VIII      *Exposure Controls / Personal Protection***

Ensure that there is adequate ventilation to prevent airborne levels from exceeding recommended exposure limits (see Section II). Use appropriate MSHA/NIOSH approved safety equipment. Wear chemical goggles, face shield, gloves, and chemical resistant clothing, such as a laboratory coat and/or a rubber apron, to prevent contact with eyes, skin, and clothing.

### **Section IX      *Physical and Chemical Properties***

#### ***Physical Data for Compound***

**Melting Pt.:** N/A

**Boiling Pt.:** N/A

**Density:** N/A

**Vapor Pressure:** N/A

**Vapor Density:** N/A

**Water Solubility:** N/A

**Appearance:** N/A

**Odor:** N/A

**Flash Point:** N/A

**Auto-Ignition Temperature:** N/A

**LEL:** N/A

**UEL:** N/A

### **Section X      *Stability and Reactivity***

#### ***Reactivity Data for Compound***

**Stability:** stable

**Incompatibilities:** N/A

**Hazardous Decomposition Products:** N/A

**Hazardous Effects of Polymerization:** no

### **Section XI      *Toxicological Information***

See Section II for specific toxicological information for the ingredients of this product.

### **Section XII      *Ecological Information***

No information is available.

### **Section XIII      *Disposal Considerations***

Recycle, if possible. Any material which cannot be saved for recovery or recycling should be disposed of at an appropriate and approved waste disposal facility. Processing, use, and/or contamination of this product may change waste management requirements. Observe all applicable federal, state, and local environmental regulations concerning disposal.

### **Section XIV      *Transport Information***

**Shipment Type:** Dangerous Goods in Excepted Quantity (US DOT Small Quantity Exemption)

**UN Number:** UN3316

**Shipping Class:** 9

**Packing Group:** N/A

### **Section XV      *Regulatory Information***

No information is available.

**Section XVI      Other Information**

The above information is believed to be correct, but does not purport to be all-inclusive. This data should be used only as a guide in handling this material. ULTRA Scientific, Inc., shall not be held liable for any damage resulting from handling or from contact with the above product.

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Close

# Material Safety Data Sheet

ULTRA Scientific · 250 Smith Street · North Kingstown, RI, USA 02852 · 401-294-9400

Product # RPE-063A

Last Updated: 11/14/2006

## Section I Product Identification

**Name:** 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin**Matrix:** neat compound

## Section II Composition / Information on Ingredients

Component	CAS #	% by Wt.	LD50	OSHA PEL	ACGIH TLV	RTECS #	Codes
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	035822-46-9	100	N/A	N/A	N/A	N/A	G

**Codes:** A-OSHA regulated carcinogen; B-IARC Group 1 carcinogen; C-IARC Group 2A carcinogen; D-IARC Group 2B carcinogen; E-NTP Group 1 carcinogen; F-NTP Group 2 carcinogen; G-SARA Title III compound; H-California Proposition 65 compound.

## Section III Hazards Identification

All chemicals should be considered hazardous - direct physical contact should be avoided.

## Section IV First Aid Measures

- Inhalation:** If inhaled, remove to fresh air. Give oxygen, if necessary. Contact a physician.
- Skin Contact:** In case of skin contact, flush with copious amounts of water. Remove contaminated clothing. Contact a physician.
- Eye Contact:** In case of eye contact, flush with copious amounts of water, lifting eyelids occasionally. Contact a physician.
- Ingestion:** If ingested, contact poison center immediately for recommended procedure. Contact a physician.

## Section V Fire Fighting Measures

**Fire and Explosion Hazard Data for Compound****Fire Hazard:** N/A**Extinguishing Media:** Carbon dioxide, dry chemical powder, or water spray.

## Section VI Accidental Release Measures

Ventilate area of the leak or spill. Wear appropriate personal protective equipment as specified in Section VIII. A leaking bottle, vial, or ampule may be placed in a plastic bag, and normal disposal procedures followed. Take up spilled material with sand or other non-combustible absorbant material, and place in an appropriate container for later disposal. Flush spill area with water.

## Section VII Handling and Storage

May be stored at room temperature

Keep in a tightly closed container, and store in a corrosion proof area.

This product should only be used by persons trained in the safe handling of hazardous chemicals.

### **Section VIII      *Exposure Controls / Personal Protection***

Ensure that there is adequate ventilation to prevent airborne levels from exceeding recommended exposure limits (see Section II). Use appropriate MSHA/NIOSH approved safety equipment. Wear chemical goggles, face shield, gloves, and chemical resistant clothing, such as a laboratory coat and/or a rubber apron, to prevent contact with eyes, skin, and clothing.

### **Section IX      *Physical and Chemical Properties***

#### ***Physical Data for Compound***

***Melting Pt.:*** N/A

***Boiling Pt.:*** N/A

***Density:*** N/A

***Vapor Pressure:*** N/A

***Vapor Density:*** N/A

***Water Solubility:*** N/A

***Appearance:*** N/A

***Odor:*** N/A

***Flash Point:*** N/A

***Auto-Ignition Temperature:*** N/A

***LEL:*** N/A

***UEL:*** N/A

### **Section X      *Stability and Reactivity***

#### ***Reactivity Data for Compound***

***Stability:*** stable

***Incompatibilities:*** N/A

***Hazardous Decomposition Products:*** N/A

***Hazardous Effects of Polymerization:*** no

### **Section XI      *Toxicological Information***

See Section II for specific toxicological information for the ingredients of this product.

### **Section XII      *Ecological Information***

No information is available.

### **Section XIII      *Disposal Considerations***

Recycle, if possible. Any material which cannot be saved for recovery or recycling should be disposed of at an appropriate and approved waste disposal facility. Processing, use, and/or contamination of this product may change waste management requirements. Observe all applicable federal, state, and local environmental regulations concerning disposal.

### **Section XIV      *Transport Information***

***Shipment Type:*** Dangerous Goods in Excepted Quantity (US DOT Small Quantity Exemption)

***UN Number:*** UN3316

***Shipping Class:*** 9

***Packing Group:*** N/A

### **Section XV      *Regulatory Information***

No information is available.

### **Section XVI      *Other Information***

The above information is believed to be correct, but does not purport to be all-inclusive. This data should be used only as a guide in handling this material. ULTRA Scientific, Inc., shall not be held liable for any damage resulting from handling or from contact with the above product.

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# Material Safety Data Sheet

ULTRA Scientific · 250 Smith Street · North Kingstown, RI, USA 02852 · 401-294-9400

Product # RPE-043A

Last Updated: 11/14/2006

## Section I Product Identification

**Name:** 1,2,3,4,7,8-Hexachlorodibenzofuran**Matrix:** neat compound

## Section II Composition / Information on Ingredients

Component	CAS #	% by Wt.	LD50	OSHA PEL	ACGIH TLV	RTECS #	Codes
1,2,3,4,7,8-hexachlorodibenzofuran	070648-26-9	100	N/A	N/A	N/A	N/A	G

**Codes:** A-OSHA regulated carcinogen; B-IARC Group 1 carcinogen; C-IARC Group 2A carcinogen; D-IARC Group 2B carcinogen; E-NTP Group 1 carcinogen; F-NTP Group 2 carcinogen; G-SARA Title III compound; H-California Proposition 65 compound.

## Section III Hazards Identification

Contains carcinogen(s) or cancer suspect agent(s)

Toxic

All chemicals should be considered hazardous - direct physical contact should be avoided.

## Section IV First Aid Measures

**Inhalation:** If inhaled, remove to fresh air. Give oxygen, if necessary. Contact a physician.**Skin Contact:** In case of skin contact, flush with copious amounts of water. Remove contaminated clothing. Contact a physician.**Eye Contact:** In case of eye contact, flush with copious amounts of water, lifting eyelids occasionally. Contact a physician.**Ingestion:** If ingested, contact poison center immediately for recommended procedure. Contact a physician.

## Section V Fire Fighting Measures

**Fire and Explosion Hazard Data for Compound****Fire Hazard:** N/A**Extinguishing Media:** Carbon dioxide, dry chemical powder, or water spray.

## Section VI Accidental Release Measures

Ventilate area of the leak or spill. Wear appropriate personal protective equipment as specified in Section VIII. A leaking bottle, vial, or ampule may be placed in a plastic bag, and normal disposal procedures followed. Take up spilled material with sand or other non-combustible absorbant material, and place in an appropriate container for later disposal. Flush spill area with water.

## Section VII Handling and Storage

May be stored at room temperature

Keep in a tightly closed container, and store in a corrosion proof area.

This product should only be used by persons trained in the safe handling of hazardous chemicals.

### **Section VIII      *Exposure Controls / Personal Protection***

Ensure that there is adequate ventilation to prevent airborne levels from exceeding recommended exposure limits (see Section II). Use appropriate MSHA/NIOSH approved safety equipment. Wear chemical goggles, face shield, gloves, and chemical resistant clothing, such as a laboratory coat and/or a rubber apron, to prevent contact with eyes, skin, and clothing.

### **Section IX      *Physical and Chemical Properties***

#### ***Physical Data for Compound***

***Melting Pt.:*** N/A

***Boiling Pt.:*** N/A

***Density:*** N/A

***Vapor Pressure:*** N/A

***Vapor Density:*** N/A

***Water Solubility:*** N/A

***Appearance:*** N/A

***Odor:*** N/A

***Flash Point:*** N/A

***Auto-Ignition Temperature:*** N/A

***LEL:*** N/A

***UEL:*** N/A

### **Section X      *Stability and Reactivity***

#### ***Reactivity Data for Compound***

***Stability:*** stable

***Incompatibilities:*** N/A

***Hazardous Decomposition Products:*** N/A

***Hazardous Effects of Polymerization:*** no

### **Section XI      *Toxicological Information***

See Section II for specific toxicological information for the ingredients of this product.

### **Section XII      *Ecological Information***

No information is available.

### **Section XIII      *Disposal Considerations***

Recycle, if possible. Any material which cannot be saved for recovery or recycling should be disposed of at an appropriate and approved waste disposal facility. Processing, use, and/or contamination of this product may change waste management requirements. Observe all applicable federal, state, and local environmental regulations concerning disposal.

### **Section XIV      *Transport Information***

***Shipment Type:*** Dangerous Goods in Excepted Quantity (US DOT Small Quantity Exemption)

***UN Number:*** UN3316

***Shipping Class:*** 9

***Packing Group:*** N/A

### **Section XV      *Regulatory Information***

No information is available.

**Section XVI      Other Information**

The above information is believed to be correct, but does not purport to be all-inclusive. This data should be used only as a guide in handling this material. ULTRA Scientific, Inc., shall not be held liable for any damage resulting from handling or from contact with the above product.

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# Material Safety Data Sheet

ULTRA Scientific · 250 Smith Street · North Kingstown, RI, USA 02852 · 401-294-9400

Product # RPE-058A

Last Updated: 11/14/2006

## Section I Product Identification

**Name:** 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin**Matrix:** neat compound

## Section II Composition / Information on Ingredients

Component	CAS #	% by Wt.	LD50	OSHA PEL	ACGIH TLV	RTECS #	Codes
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	039227-28-6	100	0.825 mg/kg oral rat	N/A	N/A	N/A	G

**Codes:** A-OSHA regulated carcinogen; B-IARC Group 1 carcinogen; C-IARC Group 2A carcinogen; D-IARC Group 2B carcinogen; E-NTP Group 1 carcinogen; F-NTP Group 2 carcinogen; G-SARA Title III compound; H-California Proposition 65 compound.

## Section III Hazards Identification

Contains carcinogen(s) or cancer suspect agent(s)

Toxic

All chemicals should be considered hazardous - direct physical contact should be avoided.

## Section IV First Aid Measures

- Inhalation:** If inhaled, remove to fresh air. Give oxygen, if necessary. Contact a physician.
- Skin Contact:** In case of skin contact, flush with copious amounts of water. Remove contaminated clothing. Contact a physician.
- Eye Contact:** In case of eye contact, flush with copious amounts of water, lifting eyelids occasionally. Contact a physician.
- Ingestion:** If ingested, contact poison center immediately for recommended procedure. Contact a physician.

## Section V Fire Fighting Measures

**Fire and Explosion Hazard Data for Compound****Fire Hazard:** N/A**Extinguishing Media:** Carbon dioxide, dry chemical powder, or water spray.

## Section VI Accidental Release Measures

Ventilate area of the leak or spill. Wear appropriate personal protective equipment as specified in Section VIII. A leaking bottle, vial, or ampule may be placed in a plastic bag, and normal disposal procedures followed. Take up spilled material with sand or other non-combustible absorbant material, and place in an appropriate container for later disposal. Flush spill area with water.

## Section VII Handling and Storage

May be stored at room temperature

Keep in a tightly closed container, and store in a corrosion proof area.

This product should only be used by persons trained in the safe handling of hazardous chemicals.

### **Section VIII Exposure Controls / Personal Protection**

Ensure that there is adequate ventilation to prevent airborne levels from exceeding recommended exposure limits (see Section II). Use appropriate MSHA/NIOSH approved safety equipment. Wear chemical goggles, face shield, gloves, and chemical resistant clothing, such as a laboratory coat and/or a rubber apron, to prevent contact with eyes, skin, and clothing.

### **Section IX Physical and Chemical Properties**

#### **Physical Data for Compound**

**Melting Pt.:** N/A

**Boiling Pt.:** N/A

**Density:** N/A

**Vapor Pressure:** N/A

**Vapor Density:** N/A

**Water Solubility:** N/A

**Appearance:** N/A

**Odor:** N/A

**Flash Point:** N/A

**Auto-Ignition Temperature:** N/A

**LEL:** N/A

**UEL:** N/A

### **Section X Stability and Reactivity**

#### **Reactivity Data for Compound**

**Stability:** stable

**Incompatibilities:** N/A

**Hazardous Decomposition Products:** N/A

**Hazardous Effects of Polymerization:** no

### **Section XI Toxicological Information**

See Section II for specific toxicological information for the ingredients of this product.

### **Section XII Ecological Information**

No information is available.

### **Section XIII Disposal Considerations**

Recycle, if possible. Any material which cannot be saved for recovery or recycling should be disposed of at an appropriate and approved waste disposal facility. Processing, use, and/or contamination of this product may change waste management requirements. Observe all applicable federal, state, and local environmental regulations concerning disposal.

### **Section XIV Transport Information**

**Shipment Type:** Dangerous Goods in Excepted Quantity (US DOT Small Quantity Exemption)

**UN Number:** UN3316

**Shipping Class:** 9

**Packing Group:** N/A

### **Section XV Regulatory Information**

No information is available.



**Section XVI      Other Information**

The above information is believed to be correct, but does not purport to be all-inclusive. This data should be used only as a guide in handling this material. ULTRA Scientific, Inc., shall not be held liable for any damage resulting from handling or from contact with the above product.

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# MATERIAL SAFETY DATA SHEET

MSDS Number  
D-602N

 **AccuStandard**  
125 Market Street • New Haven, CT USA 06513  
Phone No: (203) 786-5290 • Fax No: (203) 786-5287

Emergency Phone Number  
203-786-5290  
Mon. to Fri. 8am-5pm EDT

**Product Number :** D-602N

**Product Name :** 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin

**Synonyms :** N/A

**Formula :** C<sub>12</sub> H<sub>2</sub> Cl<sub>6</sub> O<sub>2</sub>

**Molecular Weight :** 390.84

## Section 2 - Composition / Information on Ingredients

Component(s) ( 1 )	CAS #	Appr. %	ACGIH TLV	OSHA PEL
			TWA mg/m <sup>3</sup> SKIN	TWA mg/m <sup>3</sup> SKIN
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653-85-7	100%		

## Section 3 - Hazards Identification

### Symptoms of Exposure:

May be harmful if inhaled, swallowed, or absorbed through the skin.

### Potential Health Effects:

No applicable information found.

### Routes of Entry:

Inhalation, ingestion or skin contact.

### Carcinogenicity:

Suspected human carcinogenic substance. Suspect Cancer Hazard.

WARNING: This product contains a chemical(s) known to the state of California to cause cancer.

## Section 4 - First Aid Measures

### First Aid Procedures:

GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.

Skin: Immediately flush thoroughly with large amounts of water.

Eyes: Immediately flush thoroughly with water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped. Contact a physician

Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

Remove contaminated clothing and wash before reuse

MSDS#  
D-602N

Alteration of any information contained herein without  
written permission from AccuStandard strictly prohibited.

Preparation Date  
6/29/2004

## Section 5 - Fire Fighting Measures

### Fire fighting measures for the Compound

#### Flammable Properties:

Flash Point (°F): N/A

Flammable Limits LEL (%): N/A

Flammable Limits UEL (%): N/A

Thermal decomposition produces toxic fumes.

#### Extinguishing Media:

Use water spray, dry chemical, CO2, or "alcohol" foam.

#### Protection of Firefighters:

Wear self-contained breathing apparatus and protective clothing.

## Section 6 - Accidental Release Measures

### Spill Response:

Wear suitable protective equipment listed under Expose /Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

## Section 7 - Handling and Storage

Keep container closed.

Store in a cool area away from ignition sources and oxidizers.

Do not breathe vapor.

Do not get in eyes, on skin, or on clothing.

## Section 8 - Exposure Controls / Personal Protection

### Personal Protection Equipment (PPE):

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves must be worn to prevent skin contact.

(Butyl Rubber, Viton or equivalent)

Safety glasses with side shields must be worn at all times.

**General Hygiene Considerations:**

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

## Section 9 - Physical and Chemical Properties

### Physical and chemical properties for the Compound

Appearance: White crystals  
Boiling Point: N/A  
Melting Point: N/A  
Specific Gravity (Water = 1): N/A  
Vapor Pressure: N/A  
Vapor Density (Air = 1): N/A  
Percent Volatile (by volume): N/A  
Evaporation Rate (Butyl acetate = 1): N/A  
Flash Point: N/A  
Explosion Limits (%): N/A to N/A  
Solubility in water (%): N/A

## Section 10 - Stability and Reactivity

### Stability and reactivity for the Compound

Stability: Stable  
Materials to Avoid: Oxidizers  
Hazardous Decomposition: Oxides of carbon  
Hazardous Polymerization: Does not occur  
Conditions to Avoid:

**Section 11 - Toxicological Information**

See section 3 for specific toxicological information for the ingredients of this product.

**Section 12 - Ecological Information**

By complying with sections 6 and 7 there will be no release to the environment.

**Section 13 - Disposal Considerations**

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

**Section 14 - Transport Information**

DOT      Shipping Class:    6.1                      Packing Group:    II                      UN Number:    UN2811

**Section 15 - Regulatory Information**

In addition to Federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

The following regulations apply:  
None.

**Section 16 - Other Information**

This document has been designed to meet the requirements of OSHA, ANSI and CHIPs regulations.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. It is intended for use only by persons having the necessary technical skill and at their own discretion and risk. Since conditions and manner of use are outside our control, we make NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE.

\*\*\* End of document \*\*\*

# MATERIAL SAFETY DATA SHEET

MSDS Number  
D-605N

 **AccuStandard**  
125 Market Street • New Haven, CT USA 06513  
Phone No: (203) 786-5290 • Fax No: (203) 786-5287

Emergency Phone Number  
203-786-5290  
Mon. to Fri. 8am-5pm EDT

**Product Number :** D-605N

**Product Name :** 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin.

**Synonyms :** N/A

**Formula :** C<sub>12</sub>H<sub>2</sub>Cl<sub>6</sub>O<sub>2</sub>

**Molecular Weight :** N/A

## Section 2 - Composition / Information on Ingredients

Component(s) ( 1 )	CAS #	Appr. %	ACGIH TLV	OSHA PEL
			TWA mg/m <sup>3</sup> SKIN	TWA mg/m <sup>3</sup> SKIN
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408-74-3	100%		

## Section 3 - Hazards Identification

### Symptoms of Exposure:

Harmful if inhaled, swallowed, or absorbed through the skin.

### Potential Health Effects:

No applicable information found.

### Routes of Entry:

Inhalation, ingestion or skin contact.

### Carcinogenicity:

Proven animal carcinogenic substance. Possible Cancer Hazard.

## Section 4 - First Aid Measures

### First Aid Procedures:

GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.

Skin: Immediately flush thoroughly with large amounts of water.

Eyes: Immediately flush thoroughly with water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped. Contact a physician

Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

Remove contaminated clothing and wash before reuse.

MSDS#  
D-605N

Alteration of any information contained herein without  
written permission from AccuStandard strictly prohibited.

Preparation Date  
6/29/2004

## Section 5 - Fire Fighting Measures

### Fire fighting measures for the Compound

#### Flammable Properties:

Flash Point (°F): N/A

Flammable Limits LEL (%): N/A

Flammable Limits UEL (%): N/A

Thermal decomposition produces toxic fumes.

#### Extinguishing Media:

Use water spray, dry chemical, CO2, or "alcohol" foam.

#### Protection of Firefighters:

Wear self-contained breathing apparatus and protective clothing.

## Section 6 - Accidental Release Measures

#### Spill Response:

Wear suitable protective equipment listed under Expose /Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

## Section 7 - Handling and Storage

Keep container closed.

Store in a cool area away from ignition sources and oxidizers.

Do not breathe vapor.

Do not get in eyes, on skin, or on clothing.

## Section 8 - Exposure Controls / Personal Protection

#### Personal Protection Equipment (PPE):

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves must be worn to prevent skin contact.

(Butyl Rubber, Viton or equivalent)

Safety glasses with side shields must be worn at all times.

**General Hygiene Considerations:**

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

## Section 9 - Physical and Chemical Properties

### Physical and chemical properties for the Compound

Appearance: Orange powder.  
Boiling Point: N/A  
Melting Point: N/A  
Specific Gravity (Water = 1): N/A  
Vapor Pressure: N/A  
Vapor Density (Air = 1): N/A  
Percent Volatile (by volume): N/A  
Evaporation Rate (Butyl acetate = 1): N/A  
Flash Point: N/A  
Explosion Limits (%): N/A to N/A  
Solubility in water (%): Soluble

## Section 10 - Stability and Reactivity

### Stability and reactivity for the Compound

Stability: Stable  
Materials to Avoid: Oxidizers  
  
Hazardous Decomposition: Oxides of carbon  
Hazardous Polymerization: Does not occur  
Conditions to Avoid: None indicated



## Section 11 - Toxicological Information

See section 3 for specific toxicological information for the ingredients of this product.

## Section 12 - Ecological Information

By complying with sections 6 and 7 there will be no release to the environment.

## Section 13 - Disposal Considerations

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

## Section 14 - Transport Information

DOT      Shipping Class:    6.1                      Packing Group:    II                      UN Number:    UN2811

## Section 15 - Regulatory Information

In addition to Federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

The following regulations apply:

The CAS number of this product is NOT listed on the TSCA Inventory. For reasearch and development use only. Not for manufacturing or commercial purposes.

## Section 16 - Other Information

This document has been designed to meet the requirements of OSHA, ANSI and CHIPs regulations.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. It is intended for use only by persons having the necessary technical skill and at their own discretion and risk. Since conditions and manner of use are outside our control, we make NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE.

\*\*\* End of document \*\*\*

Close

# Material Safety Data Sheet

ULTRA Scientific · 250 Smith Street · North Kingstown, RI, USA 02852 · 401-294-9400

Product # RPE-042A

Last Updated: 11/14/2006

## Section I Product Identification

**Name:** 1,2,3,7,8-Pentachlorodibenzofuran**Matrix:** neat compound

## Section II Composition / Information on Ingredients

Component	CAS #	% by Wt.	LD50	OSHA PEL	ACGIH TLV	RTECS #	Codes
1,2,3,7,8-pentachlorodibenzofuran	057117-41-6	100	N/A	N/A	N/A	N/A	G

**Codes:** A-OSHA regulated carcinogen; B-IARC Group 1 carcinogen; C-IARC Group 2A carcinogen; D-IARC Group 2B carcinogen; E-NTP Group 1 carcinogen; F-NTP Group 2 carcinogen; G-SARA Title III compound; H-California Proposition 65 compound.

## Section III Hazards Identification

Contains carcinogen(s) or cancer suspect agent(s)

Toxic

All chemicals should be considered hazardous - direct physical contact should be avoided.

## Section IV First Aid Measures

**Inhalation:** If inhaled, remove to fresh air. Give oxygen, if necessary. Contact a physician.**Skin Contact:** In case of skin contact, flush with copious amounts of water. Remove contaminated clothing. Contact a physician.**Eye Contact:** In case of eye contact, flush with copious amounts of water, lifting eyelids occasionally. Contact a physician.**Ingestion:** If ingested, contact poison center immediately for recommended procedure. Contact a physician.

## Section V Fire Fighting Measures

**Fire and Explosion Hazard Data for Compound****Fire Hazard:** N/A**Extinguishing Media:** Carbon dioxide, dry chemical powder, or water spray.

## Section VI Accidental Release Measures

Ventilate area of the leak or spill. Wear appropriate personal protective equipment as specified in Section VIII. A leaking bottle, vial, or ampule may be placed in a plastic bag, and normal disposal procedures followed. Take up spilled material with sand or other non-combustible absorbant material, and place in an appropriate container for later disposal. Flush spill area with water.

## Section VII Handling and Storage

May be stored at room temperature

Keep in a tightly closed container, and store in a corrosion proof area.

This product should only be used by persons trained in the safe handling of hazardous chemicals.

### **Section VIII Exposure Controls / Personal Protection**

Ensure that there is adequate ventilation to prevent airborne levels from exceeding recommended exposure limits (see Section II). Use appropriate MSHA/NIOSH approved safety equipment. Wear chemical goggles, face shield, gloves, and chemical resistant clothing, such as a laboratory coat and/or a rubber apron, to prevent contact with eyes, skin, and clothing.

### **Section IX Physical and Chemical Properties**

#### **Physical Data for Compound**

**Melting Pt.:** N/A

**Boiling Pt.:** N/A

**Density:** N/A

**Vapor Pressure:** N/A

**Vapor Density:** N/A

**Water Solubility:** N/A

**Appearance:** N/A

**Odor:** N/A

**Flash Point:** N/A

**Auto-Ignition Temperature:** N/A

**LEL:** N/A

**UEL:** N/A

### **Section X Stability and Reactivity**

#### **Reactivity Data for Compound**

**Stability:** stable

**Incompatibilities:** N/A

**Hazardous Decomposition Products:** N/A

**Hazardous Effects of Polymerization:** no

### **Section XI Toxicological Information**

See Section II for specific toxicological information for the ingredients of this product.

### **Section XII Ecological Information**

No information is available.

### **Section XIII Disposal Considerations**

Recycle, if possible. Any material which cannot be saved for recovery or recycling should be disposed of at an appropriate and approved waste disposal facility. Processing, use, and/or contamination of this product may change waste management requirements. Observe all applicable federal, state, and local environmental regulations concerning disposal.

### **Section XIV Transport Information**

**Shipment Type:** Dangerous Goods in Excepted Quantity (US DOT Small Quantity Exemption)

**UN Number:** UN3316

**Shipping Class:** 9

**Packing Group:** N/A

### **Section XV Regulatory Information**

No information is available.

**Section XVI      Other Information**

The above information is believed to be correct, but does not purport to be all-inclusive. This data should be used only as a guide in handling this material. ULTRA Scientific, Inc., shall not be held liable for any damage resulting from handling or from contact with the above product.

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# M A T E R I A L   S A F E T Y   D A T A   S H E E T

## SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

Company: AccuStandard, Inc.  
125 Market Street  
New Haven, CT 06513

Date MSDS Printed: 9/10/2007  
Preparation Date: 9/10/2007  
Information Phone Number: 203-786-5290  
Emergency Phone Number: 203-786-5290  
Hours: Mon. to Fri. 8am-5pm EDT

Catalog Number: D-501S

Product Name: 1,2,3,7,8-Pentachlorodibenzo-p-dioxin

Synonyms: N/A

Formula: N/A

Molecular Weight: N/A

## SECTION 2 - COMPOSITION / INFORMATION ON INGREDIENTS

Component(s)	( 1 )	CAS #	Appr. %	ACGIH-TLV (mg/m3)		OSHA-PEL (mg/m3)	
				TWA	STEL skin	TWA	STEL skin
1,2,3,7,8-Pentachlorodibenzo-p-dioxin		40321-76-4	0.005				
Toluene		108-88-3	99.995	188		x	

## SECTION 3 - HAZARDS IDENTIFICATION

### Health and Environmental Hazards/Symptoms of Exposure:

Exposure may cause lung irritation, chest pain, and pulmonary edema. Inhalation studies on toluene have demonstrated the development of inflammatory and ulcerous lesions of the penis, prepuce, and scrotum in animals. Vapors may cause drowsiness and dizziness. Aspiration of material into lungs can cause chemical pneumonitis.

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NFPA 

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### Potential Health Effects:

May be irritating to eyes.  
May be irritating to skin.  
May be harmful if absorbed through the skin.  
May be irritating to mucous membrane and upper respiratory system.  
May be harmful if inhaled.  
May be harmful if swallowed.

### Routes of Entry:

Inhalation, ingestion or skin contact.

### Carcinogenicity:

Notification of carcinogenic ingredients in quantity less than 0.1% is not required under Federal Hazard Communication Law.  
Contains one or more components that are classified (ACGIH, IARC, NTP, OSHA) as a possible cancer hazard in quantities less than 0.1%.

## SECTION 4 - FIRST AID MEASURES

### Emergency First Aid:

Get medical assistance for all cases of overexposure.  
Skin contact: Wash thoroughly with soap and water. Get medical attention if irritation develops or persists.  
Eye contact: Immediately flush with plenty of water. After initial flushing, remove and contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.  
Inhalation: Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Seek immediate medical attention.

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Ingestion: Do NOT induce vomiting. Call a physician immediately. Never give anything by mouth to an unconscious person.

## SECTION 5 - FIRE FIGHTING MEASURES

---

### Flammable Properties:

Flash Point: 40 °F (4 °C) (cc)  
Flammable Limits LEL (%): 1.3  
Flammable Limits UEL (%): 7.1  
Autoignition Temperature: 535 °C

Dangerous fire hazard.  
Containers can build up pressure if exposed to heat.  
Vapors can travel to a source of ignition and flash back.  
During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

### Extinguishing Media:

Use alcohol foam, carbon dioxide, dry chemical, or water spray when fighting fires involving this material.  
Water spray to cool fire-exposed containers and disperse vapors.

### Fire Fighting Procedures:

As in any fire, wear self-contained breathing apparatus pressure demand, MSHA/NIOSH (approved or equivalent) and full protective

## SECTION 6 - ACCIDENTAL RELEASE MEASURES

---

### Spill Response:

Wear suitable protective equipment listed under Exposure Controls / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

## SECTION 7 - HANDLING AND STORAGE

---

Store in a tightly closed container.  
Store in a cool area away from ignition sources and oxidizers.  
Electrically ground all equipment when handling this product.  
Avoid breathing vapors or mists.  
Use with adequate ventilation.  
Do not get in eyes, on skin or clothing.  
Avoid prolonged or repeated exposure.

## SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

---

### Engineering Controls and Personal Protection Equipment (PPE):

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.  
Material must be handled or transferred in an approved fume hood or with equivalent ventilation.  
(Nitrile or equivalent)  
Safety glasses with side shields must be worn at all times.  
Safety glasses with side shields should be worn at all times.

### General Hygiene Considerations:

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

## SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

---

Appearance: Clear liquid  
Odor: Aromatic  
pH: N/A

# M A T E R I A L   S A F E T Y   D A T A   S H E E T

Vapor Pressure: 21.9 mmHg (20 °C)  
Vapor Density (Air = 1): 3.2 g/l  
Boiling Point: 110.6 °C  
Melting Point: -93 °C  
Solubility in Water (%): Insoluble  
Specific Gravity (H<sub>2</sub>O = 1): 0.866 g/cm<sup>3</sup>  
Flash Point: 40 °F (4 °C) (cc)  
Explosion Limits (%): 1.3 to 7.1  
Autoignition Temperature: 535 °C  
Percent Volatile: 99+  
Evaporation Rate (BuAc = 1): 2.2  
Molecular Weight: N/A  
Molecular Formula: N/A

## SECTION 10 - STABILITY AND REACTIVITY

---

Stability: Stable

Conditions To Avoid: Heat; Contact with ignition sources

Materials To Avoid: Oxidizers  
Strong mineral acids

Hazardous Decomposition: Carbon oxides

Hazardous Polymerization: Will not occur

## SECTION 11 - TOXICOLOGICAL INFORMATION

---

See section 3 for specific toxicological information for the ingredients of this product.

## SECTION 12 - ECOLOGICAL INFORMATION

---

By complying with sections 6 and 7 there will be no release to the environment.

## SECTION 13 - DISPOSAL CONSIDERATIONS

---

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

## SECTION 14 - TRANSPORT INFORMATION

---

DOT UN Number: UN1294 Shipping Class: 3 Packing Group: II FLAMMABLE

## SECTION 15 - REGULATORY INFORMATION

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In addition to Federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

Not all components are listed on the TSCA Inventory. For research and development use only. Not for manufacturing or commercial purposes.

WARNING: This product contains chemical(s) known to the state of California to cause cancer and to cause birth defects or other reproductive harm.

## SECTION 16 - OTHER INFORMATION

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This document has been designed to meet the requirements of OSHA, ANSI and CHIPS regulations.

Catalog Number:  
D-501S

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Preparation Date: 9/10/2007

# M A T E R I A L   S A F E T Y   D A T A   S H E E T

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NO WARRANTY, EXPRESSED OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE.

Legend : N/A = Not Available   ND = Not Determined   NR = Not Regulated

\* \* \* End of Document \* \* \*



# MATERIAL SAFETY DATA SHEET

MSDS Number  
F-502S-0.1X

 **AccuStandard**  
125 Market Street • New Haven, CT USA 06513  
Phone No: (203) 786-5290 • Fax No: (203) 786-5287

Emergency Phone Number  
203-786-5290  
Mon. to Fri. 8am-5pm EDT

**Product Number :** F-502S-0.1X

**Product Name :** 2,3,4,7,8-Pentachlorodibenzofuran Solution.

**Synonyms :** N/A

**Formula :** N/A

**Molecular Weight :** N/A

## Section 2 - Composition / Information on Ingredients

Component(s)	( 2 )	CAS #	Appr. %	ACGIH TLV	OSHA PEL
				TWA mg/m3 SKIN	TWA mg/m3 SKIN
2,3,4,7,8-Pentachlorodibenzofuran		57117-31-4	0.0005%		
Toluene		108-88-3	99.99%	375	188 X

## Section 3 - Hazards Identification

### Symptoms of Exposure:

HARMFUL OR FATAL IF SWALLOWED.

HARMFUL IF INHALED.

Symptoms: headache, dizziness, hallucinations, distorted perceptions, changes in motor activity, nausea, respiratory irritation, central nervous system depression and unconsciousness as well as liver, kidney and lung damage.

May Cause Damage To Liver, Kidneys, and Respiratory System.

Causes severe eye irritation.

MAY CAUSE SKIN IRRITATION.

### Potential Health Effects:

May Cause Damage To Liver, Kidneys, and Respiratory System.

### Routes of Entry:

Inhalation, ingestion or skin contact.

### Carcinogenicity:

The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

## Section 4 - First Aid Measures

### First Aid Procedures:

MSDS#  
F-502S-0.1X

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Preparation Date  
6/29/2004

GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.

Eyes: Immediately flush thoroughly with water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

Skin: Immediately flush thoroughly with large amounts of water.

Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped. Contact a physician

Ingestion: Call a physician immediately. ONLY induce vomiting at the instructions of a physician. Never give anything by mouth to an unconscious person.

## Section 5 - Fire Fighting Measures

### Fire fighting measures for the Solvent

#### Flammable Properties:

Flash Point (°F): 40F (tcc)

Flammable Limits LEL (%): 1.30

Flammable Limits UEL (%): 7.10

Dangerous fire and explosive hazard.

Vapor can travel distances to ignition source and flash back.

#### Extinguishing Media:

Use dry chemical, foam, or CO2.

Water spray to cool fire-exposed containers.

#### Protection of Firefighters:

Wear self-contained breathing apparatus and protective clothing.

## Section 6 - Accidental Release Measures

### Spill Response:

Wear suitable protective equipment listed under Expose /Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

## Section 7 - Handling and Storage

Keep container tightly closed.

Store in a cool area away from ignition sources and oxidizers.

Do not breath vapor or mist.

Do not get in eyes, on skin, or on clothing.

Electrically ground all equipment when handling this product.

## Section 8 - Exposure Controls / Personal Protection

MSDS#  
F-502S-0.1X

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Preparation Date  
6/29/2004

**Personal Protection Equipment (PPE):**

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves should be worn to prevent skin contact.

(Viton or equivalent)

Safety glasses with side shields should be worn at all times.

**General Hygiene Considerations:**

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

**Section 9 - Physical and Chemical Properties****Physical and chemical properties for the Solvent**

Appearance: Clear liquid, aromatic odor  
Boiling Point: 111  
Melting Point: -95  
Specific Gravity (Water = 1): 0.87  
Vapor Pressure: 21.9 20C  
Vapor Density (Air = 1): 3.2  
Percent Volatile (by volume): 99+ %  
Evaporation Rate (Butyl acetate = 1): 2.2  
Flash Point: 40F (tcc)  
Explosion Limits (%): 1.30 to 7.10  
Solubility in water (%): Insoluble

**Section 10 - Stability and Reactivity**

Stability: Stable

Materials to Avoid: Oxidizers  
Other

Strong mineral acids

Hazardous Decomposition: CO>>x<< Hydrocarbons

Hazardous Polymerization: Does not occur

Conditions to Avoid: Heat; contact with ignition sources

### Section 11 - Toxicological Information

See section 3 for specific toxicological information for the ingredients of this product.

### Section 12 - Ecological Information

By complying with sections 6 and 7 there will be no release to the environment.

### Section 13 - Disposal Considerations

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

### Section 14 - Transport Information

DOT Shipping Class: 3 Packing Group: II UN Number: UN1294

### Section 15 - Regulatory Information

In addition to Federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

The following regulations apply:

Toluene is listed by the State of California as being known to the state to cause reproductive toxicity.

### Section 16 - Other Information

This document has been designed to meet the requirements of OSHA, ANSI and CHIPs regulations.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. It is intended for use only by persons having the necessary technical skill and at their own discretion and risk. Since conditions and manner of use are outside our control, we make NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE.

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Close

# Material Safety Data Sheet

ULTRA Scientific · 250 Smith Street · North Kingstown, RI, USA 02852 · 401-294-9400

Product # RPE-037

Last Updated: 11/14/2006

## Section I Product Identification

**Name:** 2,3,7,8-Tetrachlorodibenzofuran**Matrix:** neat compound

## Section II Composition / Information on Ingredients

Component	CAS #	% by Wt.	LD50	OSHA PEL	ACGIH TLV	RTECS #	Codes
2,3,7,8-tetrachlorodibenzofuran	051207-31-9	100	N/A	N/A	N/A	N/A	G

**Codes:** A-OSHA regulated carcinogen; B-IARC Group 1 carcinogen; C-IARC Group 2A carcinogen; D-IARC Group 2B carcinogen; E-NTP Group 1 carcinogen; F-NTP Group 2 carcinogen; G-SARA Title III compound; H-California Proposition 65 compound.

## Section III Hazards Identification

Contains carcinogen(s) or cancer suspect agent(s)

Toxic

All chemicals should be considered hazardous - direct physical contact should be avoided.

## Section IV First Aid Measures

- Inhalation:** If inhaled, remove to fresh air. Give oxygen, if necessary. Contact a physician.
- Skin Contact:** In case of skin contact, flush with copious amounts of water. Remove contaminated clothing. Contact a physician.
- Eye Contact:** In case of eye contact, flush with copious amounts of water, lifting eyelids occasionally. Contact a physician.
- Ingestion:** If ingested, contact poison center immediately for recommended procedure. Contact a physician.

## Section V Fire Fighting Measures

**Fire and Explosion Hazard Data for Compound****Fire Hazard:** N/A**Extinguishing Media:** Carbon dioxide, dry chemical powder, or water spray.

## Section VI Accidental Release Measures

Ventilate area of the leak or spill. Wear appropriate personal protective equipment as specified in Section VIII. A leaking bottle, vial, or ampule may be placed in a plastic bag, and normal disposal procedures followed. Take up spilled material with sand or other non-combustible absorbant material, and place in an appropriate container for later disposal. Flush spill area with water.

## Section VII Handling and Storage

May be stored at room temperature

Keep in a tightly closed container, and store in a corrosion proof area.

This product should only be used by persons trained in the safe handling of hazardous chemicals.

### **Section VIII Exposure Controls / Personal Protection**

Ensure that there is adequate ventilation to prevent airborne levels from exceeding recommended exposure limits (see Section II). Use appropriate MSHA/NIOSH approved safety equipment. Wear chemical goggles, face shield, gloves, and chemical resistant clothing, such as a laboratory coat and/or a rubber apron, to prevent contact with eyes, skin, and clothing.

### **Section IX Physical and Chemical Properties**

#### **Physical Data for Compound**

**Melting Pt.:** N/A

**Boiling Pt.:** N/A

**Density:** N/A

**Vapor Pressure:** N/A

**Vapor Density:** N/A

**Water Solubility:** N/A

**Appearance:** N/A

**Odor:** N/A

**Flash Point:** N/A

**Auto-Ignition Temperature:** N/A

**LEL:** N/A

**UEL:** N/A

### **Section X Stability and Reactivity**

#### **Reactivity Data for Compound**

**Stability:** stable

**Incompatibilities:** N/A

**Hazardous Decomposition Products:** N/A

**Hazardous Effects of Polymerization:** no

### **Section XI Toxicological Information**

See Section II for specific toxicological information for the ingredients of this product.

### **Section XII Ecological Information**

No information is available.

### **Section XIII Disposal Considerations**

Recycle, if possible. Any material which cannot be saved for recovery or recycling should be disposed of at an appropriate and approved waste disposal facility. Processing, use, and/or contamination of this product may change waste management requirements. Observe all applicable federal, state, and local environmental regulations concerning disposal.

### **Section XIV Transport Information**

**Shipment Type:** Dangerous Goods in Excepted Quantity (US DOT Small Quantity Exemption)

**UN Number:** UN3316

**Shipping Class:** 9

**Packing Group:** N/A

### **Section XV Regulatory Information**

No information is available.

**Section XVI      Other Information**

The above information is believed to be correct, but does not purport to be all-inclusive. This data should be used only as a guide in handling this material. ULTRA Scientific, Inc., shall not be held liable for any damage resulting from handling or from contact with the above product.

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# M A T E R I A L   S A F E T Y   D A T A   S H E E T

## SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

Manufacturer: AccuStandard, Inc.  
125 Market Street  
New Haven, CT 06513

Date MSDS Printed: 3/15/2006  
Preparation Date: 3/15/2006  
Information Phone Number: 203-786-5290  
Emergency Phone Number: 203-786-5290  
Hours: Mon. to Fri. 8am-5pm EDT

MSDS Number: D-404N

Product Name: 2,3,7,8-Tetrachlorodibenzo-p-dioxin

Synonyms: 2,3,7,8-Tetrachlorodibenzo-p-dioxin; TCDD; TCDBD; Tetradoxin; Dioxin

Formula:  $C_{12}H_4Cl_4O_2$

Molecular Weight: 321.96

## SECTION 2 - COMPOSITION / INFORMATION ON INGREDIENTS

Component(s)	( 1 )	CAS #	Appr. %	ACGIH-TLV (mg/m3)		OSHA-PEL (mg/m3)	
				TWA	STEL skin	TWA	STEL skin
2,3,7,8-Tetrachlorodibenzo-p-dioxin		1746-01-6	100				

## SECTION 3 - HAZARDS IDENTIFICATION

### Symptoms of Exposure:

Irritating to eyes, mucous membranes and upper respiratory system.

Causes skin redness and irritation. Repeated or prolonged exposure may cause dermatitis.

May cause stomach cramps and gastro-intestinal disturbances.

Possible reproductive and teratogenic hazard.

### Potential Health Effects:

Considered HIGHLY TOXIC.

May be fatal if inhaled, absorbed through skin, or swallowed.

May cause eye, kidney, liver, and skin damage.

### Routes of Entry:

Inhalation, ingestion or skin contact.

### Carcinogenicity:

This product is or contains a component that is classified (ACGIH, IARC, NTP, OSHA) as a cancer hazard.

## SECTION 4 - FIRST AID MEASURES

### Emergency First Aid:

MSDS Number:  
D-404N

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Preparation Date: 3/15/2006



Get medical assistance for all cases of overexposure.

Skin contact: Immediately wash skin with soap and plenty of water. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse.

Eye contact: Immediately flush with plenty of water. After initial flushing, remove and contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

Inhalation: Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Seek immediate medical attention.

Ingestion: Drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

---

## **SECTION 5 - FIRE FIGHTING MEASURES**

### **Flammable Properties:**

Flash Point: N/A

Flammable Limits LEL (%): N/A

Flammable Limits UEL (%): N/A

Autoignition Temperature: N/A

During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

### **Extinguishing Media:**

Use alcohol foam, carbon dioxide, dry chemical, or water spray when fighting fires involving this material.

### **Fire Fighting Procedures:**

As in any fire, wear self-contained breathing apparatus pressure demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

---

## **SECTION 6 - ACCIDENTAL RELEASE MEASURES**

### **Spill Response:**

Wear suitable protective equipment listed under Exposure Controls / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

---

## **SECTION 7 - HANDLING AND STORAGE**

Store in a tightly closed container.

Store in a cool area away from ignition sources and oxidizers.

Do not breathe dust.

Do not get in eyes, on skin or clothing.

Avoid prolonged or repeated exposure.

This product should only be used by persons trained in the safe handling of hazardous chemicals.

---

## **SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION**

### **Engineering Controls and Personal Protection Equipment (PPE):**

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

Material must be handled or transferred in an approved fume hood or with equivalent ventilation.

Compatible chemical-resistant protective gloves must be worn to prevent skin contact.

Safety glasses with side shields must be worn at all times.

**General Hygiene Considerations:**

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

**SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES**

---

Appearance: Colorless to white crystalline solid

Odor: N/A

pH: N/A

Vapor Pressure: Negligible

Vapor Density (Air = 1): N/A

Boiling Point: Decomposes (750 - 800 °C)

Melting Point: 305 °C (581 °F)

Solubility in Water (%): Insoluble

Specific Gravity (H<sub>2</sub>O = 1): 1.8 g/cm<sup>3</sup>

Flash Point: N/A

Explosion Limits (%): N/A to N/A

Autoignition Temperature: N/A

Percent Volatile: N/A

Evaporation Rate (BuAc = 1): N/A

Molecular Weight: 321.96

Molecular Formula: C<sub>12</sub>H<sub>3</sub>Cl<sub>4</sub>O<sub>2</sub>

**SECTION 10 - STABILITY AND REACTIVITY**

---

Stability: Stable

Conditions To Avoid: Light

Materials To Avoid: Oxidizers

Hazardous Decomposition: Carbon oxides; Produces chlorine on exposure to light

Hazardous Polymerization: Will not occur

**SECTION 11 - TOXICOLOGICAL INFORMATION**

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See section 3 for specific toxicological information for the ingredients of this product.

**SECTION 12 - ECOLOGICAL INFORMATION**

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By complying with sections 6 and 7 there will be no release to the environment.

**SECTION 13 - DISPOSAL CONSIDERATIONS**

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Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

**SECTION 14 - TRANSPORT INFORMATION**

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DOT UN Number: UN2811      Shipping Class: 6.1      Packing Group: I      VERY TOXIC

## **SECTION 15 - REGULATORY INFORMATION**

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In addition to Federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

The following regulations apply:

**WARNING:** This product contains chemical(s) known to the state of California to cause cancer and to cause birth defects or other reproductive harm.

The CAS number of this product is NOT listed on the TSCA Inventory. For reasearch and development use only. Not for manufacturing or commercial purposes.

## **SECTION 16 - OTHER INFORMATION**

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This document has been designed to meet the requirements of OSHA, ANSI and CHIPs regulations.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. It is intended for use only by persons having the necessary technical skill and at their own discretion and risk. Since conditions and manner of use are outside our control, we make  
**NO WARRANTY, EXPRESSED OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE.**

Legend : N/A = Not Available   ND = Not Determined   NR = Not Regulated

\*\*\* End of Document \*\*\*



**ALDON CORPORATION**

221 Rochester Street  
Avon, New York 14414-9409  
(585) 226-6177

MSDS No.: AA0136 AA0143 AA0144  
Effective Date: AA0145 AA0146 AA0147  
January 1, 2007


AA0135

## MATERIAL SAFETY DATA SHEET

### SECTION I NAME

Product	Aluminum Metal
Chemical Synonyms	Granular, Shot, Sheet, Strips, Turnings
Formula	Al
Unit Size	up to 2.5 Kg.
C.A.S. No.	7429-90-5

### 24 HOUR EMERGENCY ASSISTANCE

	<b>CHEMTREC</b> 800-424-9300 Day 585-226-6177	Health 0 Fire 1 Reactivity 1
<b>NFPA</b>		<b>HMIS *</b>
HAZARD RATING		
MINIMAL SLIGHT MODERATE SERIOUS SEVERE	0 1 2 3 4	

### SECTION II INGREDIENTS OF MIXTURES

Principal Component(s)	%	TLV Units
Aluminum metal	>99.5	See Section V.

**CAUTION! INHALATION AS DUST OR FUME MAY CAUSE IRRITATION.**

### SECTION III PHYSICAL DATA

Melting Point (°F)	660°C (1220°F)	Specific Gravity (H <sub>2</sub> O = 1)	N/A
Boiling Point (°F)	N/A	Percent Volatile by Volume (%)	N/A
Vapor Pressure (mm Hg)	N/A	Evaporation Rate (-1)	N/A
Vapor Density (Air=1)	0.095 - 0.113 lb/in <sup>3</sup>		
Solubility in Water	Insoluble.		
Appearance & Odor	Silver gray colored metal, granular, shot, sheet, strips, turnings. No odor.		

### SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used)	N/A	Flammable Limits in Air % by Volume	N/A	Lower	Upper
Extinguisher Media	Halogenated extinguishing agents should not be used. To control the spread of fire, do not use water. Ring small fire with sand, eliminate drafts, let fire extinguish itself.				

### SPECIAL FIREFIGHTING PROCEDURES

In fire conditions, wear a NIOSH/MSHA-approved self-contained breathing apparatus and full protective clothing.

### UNUSUAL FIRE AND EXPLOSION HAZARDS

Dust clouds may be explosive. Prevent formation of a dust cloud. Bulk dust when damp may heat spontaneously. Hazard greater as fineness increases. Reacts with some acids and caustic solutions to produce hydrogen. Molten aluminum may explode on contact with water. It may also react violently with rust, certain metal oxides (e.g. oxides of copper, iron and lead) and nitrates (e.g. ammonium nitrate and fertilizers containing ammonium nitrate).

### SECTION V HEALTH HAZARD DATA

AA0135

#### Threshold Limited Value

TWA: 10 mg/m<sup>3</sup> (ACGIH 2001) as aluminum metal dust.

#### Effects of Overexposure

**INGESTION:** May cause irritation. Exercise appropriate procedures to minimize potential hazards. **EYES:** Particles of aluminum in the eye may cause injury to the cornea. **INHALATION:** It has been reported in the literature that chronic exposure to aluminum dust has been suspected of causing lung injury. Target organs: None known.

#### Emergency and First Aid Procedures

**INGESTION:** Call physician or Poison Control Center immediately. Induce vomiting only if advised by appropriate medical personnel. Never give anything by mouth to an unconscious person. **EYES:** Check for and remove contact lenses. Flush thoroughly with water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get immediate medical attention. **SKIN:** Remove contaminated clothing. Flush thoroughly with mild soap and water. If irritation occurs, get medical attention. **INHALATION:** Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

### SECTION VI REACTIVITY DATA

Stability	Unstable	Conditions to Avoid	Heat, spark, flame, water and strong oxidizing agents.
	Stable	X	

Incompatibility (Materials to Avoid)	Strong oxidizers, acids, alkalies, halogenated compounds, heat and water.
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Hazardous Decomposition Products	Aluminum reacts with water, acids or alkalies to generate hydrogen.
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Hazardous Polymerization	Conditions to Avoid
May Occur	Will Not Occur
	X
	Not applicable.

### SECTION VII SPILL OR LEAK PROCEDURES

Steps to be taken in case material is released or spilled	Recover when possible. Sweep material onto paper. Place in a fiber carton. Wash spill area well with soap and water.
---	--

Waste Disposal Method	Discharge, treatment, or disposal may be subject to Federal, State or Local laws. These disposal guidelines are intended for the disposal of catalog-size quantities only.
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Dispose of in accordance with federal, state and local regulations.

### SECTION VIII SPECIAL PROTECTION INFORMATION

Respiration Protection (Specify Type)	None needed in normal laboratory handling. If dusty conditions prevail, wear a NIOSH/MSHA-approved dust mask or work in ventilation hood.			
Ventilation	Local Exhaust	Recommended.	Special	No.
	Mechanical (General)	Recommended.	Other	No.
Protective Gloves	Rubber.	Eye Protection	Chemical safety glasses.	

Other Protective Equipment	Goggles, safety glasses, lab coat, fire extinguisher, eye wash station.
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### SECTION IX SPECIAL PRECAUTIONS

Precautions to be Taken in Handling & Storing	Store in a dry place away from acids, alkalies and oxidizers. Dangerous when wet, take precautions. Wash thoroughly after handling.
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Other Precautions	Read label on container before using. Do not wear contact lenses when working with chemicals. For laboratory use only. Not for drug, food or household use. Keep out of reach of children.
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Sheets and/or strips have sharp edges. Use caution when handling. Remove and wash contaminated clothing.

Revision No.	12	Date	01/01/07	Approved	James A. Bertsch	Chemical Safety Coordinator	JAB
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The information contained herein is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees. \* Hazardous Materials Industrial Standards. Printed on recycled paper.

D.O.T. Non Regulated.

Approved by U.S. Department of Labor "essentially similar" to form OSHA-20



# MATERIAL SAFETY DATA SHEET

5100 W. Henrietta Rd.  
West Henrietta, NY 14586  
TEL: (866) 260-0501

MSDS No. 9500302  
Effective Date: December 1, 2005

## SECTION I NAME 24 HOUR EMERGENCY ASSISTANCE

Product	Barium Metal	<b>416-984-3000</b>  <b>NFPA</b>  <b>HAZARD RATING</b> Minimal Slight Moderate Serious Severe 0 1 2 3 4 <b>WHMIS</b> Health 1 Flammability 3 Reactivity 2
Chemical Synonyms	Barium	
Formula	Ba	
CAS No.	7440-39-3	

## SECTION II DANGEROUS INGREDIENTS

Name	%	TLV Units
Barium metal - Immersed in mineral oil	100%	N/A
<b>DANGER! FLAMMABLE SOLID! DANGEROUS WHEN WET!</b>		

## SECTION III PHYSICAL DATA

Melting Point (°C)	850°C	Specific Gravity (H <sub>2</sub> O = 1)	3.74
Boiling Point (°C)	1695°C	Percent Volatile by Volume (%)	N/A
Vapor Pressure (mm Hg)	N/A	Evaporation Rate (=1)	N/A
Vapor Density (Air=1)	N/A		
Solubility in Water	Reacts violently with water. Produces extremely flammable gases.		
Appearance & Odor	Soft, silvery, lustrous metal immersed in heavy mineral oil; no odor.		

## SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash point	Flammable solid.	Flammable Limits in Air % by Volume	N/A	Lower	Upper
Firefighting Procedures					

DO NOT USE WATER. Use dry sand, earth, dolomite or sodium chloride. In fire conditions, fire-fighters should wear an appropriate mask or a self-containing breathing apparatus.

### Flammability and Explosion Hazards

Reaction with water produces explosive hydrogen gas and enough heat to ignite gas/air mixture plus toxic, corrosive Barium hydroxide solution.

**TDG** Class 4.3 Material that emits flammable gases on contact with water. UN2813

The information contained herein is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees. For laboratory use only. Not for drug, food or household use. Keep out of reach of children. Printed on recycled paper.

## SECTION V REACTIVITY DATA

BB0003

Chemical Stability	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	If no, under what conditions?
Incompatible with Other products	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Water, acids, oxidizers, chlorinated and fluorinated hydrocarbons such as CCl <sub>4</sub> .

Hazardous Decomposition Products	Hydrogen (explosive), barium hydroxide solution (caustic/toxic).
Reactive under what conditions	Reacts violently with water, the humidity in moist air and moisture in other substances, releasing explosive hydrogen gas.

## SECTION VI TOXICOLOGICAL PROPERTIES

Route of Entry	Inhalation. Ingestion. Eyes. Skin.
TLV	Barium and soluble compounds, as Ba ACGIH 2001: TWA: 0.5 mg/m <sup>3</sup> .
Toxicity for animals	Not available.
Chronic effects on humans	Repeated or prolonged exposure to the substance can produce target organ damage. Target organs: Central nervous system, kidneys.
Acute effects on humans	Contact causes severe burns to the skin and eyes. May cause blindness.

## SECTION VII PREVENTIVE MEASURES

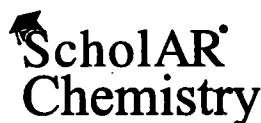
Waste Disposal	Discharge, treatment, or disposal may be subject to local laws. Consult your local or regional authorities.
Storage	Keep container in a cool, well ventilated place. Keep away from heat. Keep away from incompatible materials. Keep away from sources of ignition and open flames. Keep baryum metal immersed in mineral oil or argon.
Precautions	Avoid contact with skin and eyes. Do not ingest. If ingested, seek immediate medical attention.
Spill or leak	To prevent ignition, coat with mineral oil, soaking thoroughly and place in oiled steel container and secure tightly. Keep away from water, rain, snow, etc. Wash spill area with soap and water.
Protective Clothing	Gloves, safety glasses, lab coat, dust respirator.

## SECTION VIII FIRST AID MEASURES

Specific first aid measures	Ingestion: Call physician or Poison Control Center immediately. Induce vomiting only if advised by the appropriate medical personnel. Eye contact: Check for and remove any contact lenses. Do NOT flush with water. Carefully remove particles with cotton-tipped applicator. Seek immediate medical attention. Skin contact: Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Inhalation: Move victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Allow victim to rest in a well ventilated area. Seek immediate medical attention.
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## SECTION IX PREPARATION OF THE MSDS

Rev. No. 1 Date December 1, 2005 Approved Michael Raszeja



5100 West Henrietta Road  
West Henrietta, NY 14586  
(866) 260-0501

## MATERIAL SAFETY DATA SHEET

MSDS No. 9409804 9409904  
Effective Date: February 16, 2007

### SECTION I NAME 24 HOUR EMERGENCY ASSISTANCE

Product	Chromium Metal	<b>CHEMTREC</b> 1-800-424-9300  <b>NFPA</b>  <b>HAZARD RATING</b> Minimal Slight Moderate Serious Severe 0 1 2 3 4  <b>WHMIS</b>
Chemical Synonyms	Chromium; Chrome	
Formula	Cr	
CAS No.	7440-47-3	

### SECTION II DANGEROUS INGREDIENTS

Name	%	TLV Units
Chromium metal	100%	TWA: 0.5 mg/m <sup>3</sup>
<b>CAUTION!</b>		

### SECTION III PHYSICAL DATA

Melting Point (°C)	1830°C	Specific Gravity (H <sub>2</sub> O = 1)	7.20 @ 20°C
Boiling Point (°C)	2200°C	Percent Volatile by Volume (%)	N/A
Vapor Pressure (mm Hg)	N/A	Evaporation Rate (=1)	N/A
Vapor Density (Air=1)	N/A		
Solubility in Water	Insoluble.		
Appearance & Odor	Steel-grey pieces or granules; no odor.		

### SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash point	Not flammable.	Flammable Limits in Air % by Volume	N/A	Lower	Upper
Firefighting Procedures					

Use dry chemical, CO<sub>2</sub>, alcohol foam, or water spray. In fire conditions, fire-fighters should wear an appropriate mask or a self-containing breathing apparatus.

#### Flammability and Explosion Hazards

Negligible fire hazard in metallic form; however, possible fire and explosion hazard in dust form when exposed to heat or flame.

Auto-ignition temperature: 400°C as dust.

**TDG** Not a TDG controlled material.

The information contained herein is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees. For laboratory use only. Not for drug, food or household use. Keep out of reach of children. Printed on recycled paper.

### SECTION V REACTIVITY DATA CC0285

Chemical Stability	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	If no, under what conditions?
Incompatible with Other products	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Attacked by caustic alkalies and alkali carbonates, acids, strong oxidizers.

Hazardous Decomposition Products	Chromium fumes.
Reactive under what conditions	Not applicable.

### SECTION VI TOXICOLOGICAL PROPERTIES

Route of Entry	Inhalation. Ingestion.
TLV	TWA: 0.5 mg/m <sup>3</sup> as Cr and inorganic compounds
Toxicity for animals	Not available.
Chronic effects on humans	<b>WARNING: THIS PRODUCT CONTAINS A CHEMICAL KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.</b> Suspect cancer hazard. Repeated or prolonged exposure to the substance can produce target organ damage. Risk of cancer depends on level and duration of exposure. Target organs: Lungs, kidneys.
Acute effects on humans	May be harmful if inhaled or swallowed. Contact may cause irritation to the skin and eyes.

### SECTION VII PREVENTIVE MEASURES

Waste Disposal	Discharge, treatment, or disposal may be subject to local laws. Consult your local or regional authorities.
Storage	Keep container in a cool, well ventilated place. Keep away from heat. Keep away from incompatible materials. Keep away from sources of ignition and open flames.
Precautions	Avoid contact with skin and eyes. Do not breathe dust. Use with adequate ventilation. Do not ingest. If ingested, seek immediate medical attention.
Spill or leak	Use appropriate tools to put the spilled solid in a convenient waste disposal container. Wash spill area with soap and water.
Protective Clothing	Gloves, safety glasses, lab coat, dust respirator.

### SECTION VIII FIRST AID MEASURES



Specific first aid measures	Ingestion: Call physician or Poison Control Center immediately. Induce vomiting only if advised by the appropriate medical personnel. Eye contact: Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Seek medical attention. Skin contact: Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Inhalation: Move victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Allow victim to rest in a well ventilated area. Seek immediate medical attention.
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### SECTION IX PREPARATION OF THE MSDS

Rev. No.	3	Date	February 16, 2007	Approved	James A. Bertsch
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GARDENA, CA  
NEW BRUNSWICK, NJ

# Material Safety Data Sheet

NFPA	HMIS	Personal Protective Equipment						
	<table><tr><td>Health Hazard</td><td>1</td></tr><tr><td>Fire Hazard</td><td>0</td></tr><tr><td>Reactivity</td><td>0</td></tr></table>	Health Hazard	1	Fire Hazard	0	Reactivity	0	  See Section 15.
Health Hazard	1							
Fire Hazard	0							
Reactivity	0							

## Section 1. Chemical Product and Company Identification

Page Number: 1

Common Name/ Trade Name	Iron Metal	Catalog Number(s).	I1197, I1030, I1041, I1042
		CAS#	7439-89-6
Manufacturer	SPECTRUM LABORATORY PRODUCTS INC. 14422 S. SAN PEDRO STREET GARDENA, CA 90248	RTECS	NO4565500
		TSCA	TSCA 8(b) inventory: Iron Metal
Commercial Name(s)	Not available.	CI#	Not applicable.
Synonym	Iron metal filings; Iron Metal Wire; Iron Metal Wire, 0.25mm; Iron metal granular	<b>IN CASE OF EMERGENCY</b> <b>CHEMTREC (24hr) 800-424-9300</b>  CALL (310) 516-8000	
Chemical Name	Iron		
Chemical Family	Inert material.		
Chemical Formula	Fe		
Supplier	SPECTRUM LABORATORY PRODUCTS INC. 14422 S. SAN PEDRO STREET GARDENA, CA 90248		

## Section 2 Composition and Information on Ingredients

		Exposure Limits			
Name	CAS #	TWA (mg/m <sup>3</sup> )	STEL (mg/m <sup>3</sup> )	CEIL (mg/m <sup>3</sup> )	% by Weight
1) Iron Metal	7439-89-6				100

Toxicological Data  
on Ingredients Not applicable.

## Section 3. Hazards Identification

Potential Acute Health Effects	Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion. Non-hazardous in case of inhalation.
Potential Chronic Health Effects	<b>CARCINOGENIC EFFECTS:</b> Not available. <b>MUTAGENIC EFFECTS:</b> Not available. <b>TERATOGENIC EFFECTS:</b> Not available. <b>DEVELOPMENTAL TOXICITY:</b> Not available. The substance may be toxic to liver, cardiovascular system, upper respiratory tract, pancreas. Repeated or prolonged exposure to the substance can produce target organs damage.

Continued on Next Page

**Section 4. First Aid Measures**

Eye Contact	Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.
Skin Contact	Wash with soap and water. Get medical attention if irritation develops.
Serious Skin Contact	Not available.
Inhalation	If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Serious Inhalation	Not available.
Ingestion	Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.
Serious Ingestion	Not available.

**Section 5. Fire and Explosion Data**

Flammability of the Product	Non-flammable.
Auto-Ignition Temperature	Not available.
Flash Points	Not available.
Flammable Limits	Not available.
Products of Combustion	Some metallic oxides.
Fire Hazards in Presence of Various Substances	Not applicable.
Explosion Hazards in Presence of Various Substances	Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.
Fire Fighting Media and Instructions	Not applicable.
Special Remarks on Fire Hazards	Chlorine Trifluoride reacts with iron with incandescence. Powdered iron reacts with fluorine below redness with incandescence. Reduced iron decomposes with nitrogen dioxide @ ordinary temperature with incandescence. Reacting mass formed by mixture of phosphorus and iron can become incandescent when heated. This material is flammable in powder form only.
Special Remarks on Explosion Hazards	Material in powdered form can explode when exposed to heat or flame

**Section 6. Accidental Release Measures**

Small Spill	Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.
Large Spill	Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.



**Section 7. Handling and Storage**

Precautions	Do not ingest. Do not breathe dust. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids.
Storage	Keep container tightly closed. Keep container in a cool, well-ventilated area. Moisture sensitive.

**Section 8. Exposure Controls/Personal Protection**

Engineering Controls	Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.
Personal Protection	Safety glasses. Lab coat. Gloves.
Personal Protection in Case of a Large Spill	Goggles. Boots. Gloves.
Exposure Limits	Not available.

**Section 9. Physical and Chemical Properties**

Physical state and appearance	Solid. (Metal solid.)	Odor	Odorless.
Molecular Weight	55.85 g/mole	Taste	Tasteless.
pH (1% soln/water)	Not applicable.	Color	Silver-white Grey.
Boiling Point	3000°C (5432°F)		
Melting Point	1535°C (2795°F)		
Critical Temperature	Not available.		
Specific Gravity	Density: 7.86 (Water = 1)		
Vapor Pressure	Not applicable.		
Vapor Density	Not available.		
Volatility	Not available.		
Odor Threshold	Not available.		
Water/Oil Dist. Coeff.	Not available.		
Ionicity (in Water)	Not available.		
Dispersion Properties	Not available.		
Solubility	Insoluble in cold water, hot water, diethyl ether. Insoluble in alcohol, alkali. Soluble in acids.		

**Section 10. Stability and Reactivity Data**

Stability	The product is stable.
Instability Temperature	Not available.
Conditions of Instability	Excess heat, incompatible materials, water/moisture, air
Incompatibility with various substances	Reactive with oxidizing agents, acids.
Corrosivity	Not considered to be corrosive for metals and glass.

Continued on Next Page

Special Remarks on Reactivity	<p>Hot iron(wire) burns in Chlorine gas.</p> <p>Violent decomposition of hydrogen peroxide (53% by weight or greater) may be caused by contact with iron.</p> <p>Readily oxidizes in moist air forming rust.</p> <p>Reactive with halogens.</p> <p>Incompatible with acetaldehyde, ammonium peroxodisulfate, chloroformamidine, chloric acid, ammonium nitrate, dinitrogen tetroxide, nitril fluoride, polystyrene, sodium acetylide, potassium dichromate, peroxyformic acid, sulfuric acid, sodium carbide.</p> <p>Readily attacked by dilute mineral acids and or attacked or dissolved by organic acids.</p> <p>Not appreciably attacked by cold sulfuric acid, or nitric acid, but is attacked by hot acids.</p>
Special Remarks on Corrosivity	Not available.
Polymerization	Will not occur.

### Section 11. Toxicological Information

Routes of Entry	Inhalation. Ingestion.
Toxicity to Animals	Acute oral toxicity (LD50): 30000 mg/kg [Rat].
Chronic Effects on Humans	May cause damage to the following organs liver, cardiovascular system, upper respiratory tract, pancreas.
Other Toxic Effects on Humans	<p>Slightly hazardous in case of skin contact (irritant), of ingestion.</p> <p>Non-hazardous in case of inhalation.</p>
Special Remarks on Toxicity to Animals	Not available.
Special Remarks on Chronic Effects on Humans	Not available.
Special Remarks on other Toxic Effects on Humans	<p><b>Acute Potential Health Effects</b></p> <p><b>Skin:</b></p> <p>Iron metal filings, granular, or dust: May cause skin irritation by mechanical action.</p> <p>Iron metal wire: Not likely to cause skin irritation.</p> <p><b>Eyes</b></p> <p>Iron metal filings, granular, or dust: Can irritate eyes by mechanical action.</p> <p>Iron metal wire: No hazard. Will not cause eye irritation.</p> <p><b>Inhalation:</b></p> <p>Iron dust: Can irritate the respiratory tract by mechanical action.</p> <p>Iron metal wire, granular, or filings: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count.</p> <p><b>Ingestion:</b></p> <p>Iron metal wire: Not an ingestion hazard.</p> <p>Iron metal filings granular, or dust: The amount of ingested iron which constitutes a toxic dose is not well defined. Proposed toxic doses of elemental iron are 20 mg/kg for gastrointestinal irritation to greater than 60 mg/kg for systemic toxicity.</p> <p>Gastrointestinal effects are the first signs to appear, with hemorrhagic vomiting and diarrhea, hematochezia, abdominal pain, lethargy, metabolic acidosis, coagulopathy, shock, coma and convulsions developing from 0 to 6 hours after ingestion. Leukocytosis may also occur. An asymptomatic phase may ensue at 6 to 12 hours post-ingestion, followed by hypoglycemia or hyperglycemia, hepatic and renal failure, severe acidosis, cyanosis, fever, CNS depression (lethargy, restlessness and/or confusion seizures), hypotension, and cardiovascular collapse/cardiac failure in 12 to 48 hours. Hepatic cirrhosis, gastrointestinal scarring and/or strictures may arise in 2 to 6 weeks. It may also cause an anaphylactoid reaction. Non-cardiogenic pulmonary edema also develop in severe cases of iron intoxication.</p> <p><b>Chronic Potential Health Effects</b></p> <p><b>Inhalation:</b> Chronic inhalation of iron dust can lead to accumulation in the lungs and a characteristic stippled appearance on X-rays. This condition, called <b>SIDEROSIS</b>, is considered benign in that it does not interfere with lung function and does not predispose to other disease. Chronic inhalation of iron dust may also cause fibrosis in the lungs.</p> <p><b>Ingestion:</b> Clinical signs of iron overload appear when the total body iron is 5 to 10 times higher than normal. Neurobehavioral defects including depression, decreased activity, habituation, reflex startle, and conditioned avoidance response performance may occur. However, similar effects were also seen in iron deficiency. It is therefore likely that these behavioral effects are secondary to general toxicity. High serum iron levels may be associated with an increased risk of fatal acute myocardial infarction (MI).</p> <p><b>Skin:</b> Prolonged or repeated contact may cause hypersensitivity.</p>

**Section 12. Ecological Information**

Ecotoxicity	Not available.
BOD5 and COD	Not available.
Products of Biodegradation	Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.
Toxicity of the Products of Biodegradation	The product itself and its products of degradation are not toxic.
Special Remarks on the Products of Biodegradation	Not available.

**Section 13. Disposal Considerations**

Waste Disposal	Waste must be disposed of in accordance with federal, state and local environmental control regulations.
----------------	--

**Section 14. Transport Information**

DOT Classification	Not a DOT controlled material (United States).
Identification	Not applicable.
Special Provisions for Transport	Not applicable.
DOT (Pictograms)	

**Section 15. Other Regulatory Information and Pictograms**

Federal and State Regulations	California Director's List of Hazardous Substances: Iron Metal TSCA 8(b) inventory: Iron Metal
-------------------------------	---

California Proposition 65 Warnings	California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: No products were found. California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: No products were found.
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Other Regulations	EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.
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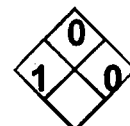
Other Classifications	WHMIS (Canada)	Not controlled under WHMIS (Canada).
	DSCG (EEC)	This product is not classified according to the EU regulations. Not applicable.

**HMS (U.S.A.)**

Health Hazard	1
Fire Hazard	0
Reactivity	0
Personal Protection	B

National Fire Protection Association (U.S.A.)

Health



Flammability

Reactivity

Specific hazard

WHMIS (Canada)  
(Pictograms)DSCL (Europe)  
(Pictograms)TDG (Canada)  
(Pictograms)ADR (Europe)  
(Pictograms)

Protective Equipment



Gloves



Lab coat.



Safety glasses

**Section 16. Other Information**

MSDS Code I3240

References Not available.

Other Special  
Considerations Not available.

Validated by Sonia Owen on 11/17/2008.

Verified by Sonia Owen.  
Printed 12/2/2008.

CALL (310) 516-8000

**Notice to Reader**

*All chemicals may pose unknown hazards and should be used with caution. This Material Safety Data Sheet (MSDS) applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this MSDS. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this MSDS is based on technical data judged to be reliable, Spectrum Quality Products, Inc. assumes no responsibility for the completeness or accuracy of the information contained herein.*




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LL0070 LL0077  
LL0079 LL0080 LL0081  
MSDS No.: LL0082 LL0085 LL0086  
Effective Date: January 12, 2007

## MATERIAL SAFETY DATA SHEET

### SECTION I NAME 24 HOUR EMERGENCY ASSISTANCE

Product	Lead Metal	 <b>CHEMTREC</b> 800-424-9300 Day 585-226-6177 <b>NFPA</b> HAZARD RATING MINIMAL SLIGHT MODERATE SERIOUS SEVERE 0 1 2 3 4	Health	3
Chemical Synonyms	N/A		Fire	0
Formula	Pb		Reactivity	0
Unit Size	up to 2.5 Kg.		<b>HMIS *</b>	
C.A.S. No.	7439-92-1			

### SECTION II INGREDIENTS OF MIXTURES

Principal Component(s)	%	TLV Units
Lead metal, shot, granular, sheet, foil	99+%	See Section V.

#### CAUTION!

MAY BE HARMFUL OR FATAL IF SWALLOWED OR INHALED AS FUMES OR DUST.

### SECTION III PHYSICAL DATA

Melting Point (°F)	Approx. 327.4°C (621°F)	Specific Gravity (H <sub>2</sub> O = 1)	11.34 (20/4°C)
Boiling Point (°F)	1753°C (3187°F)	Percent Volatile by Volume (%)	0% at ambient temp.
Vapor Pressure (mm Hg)	N/A	Evaporation Rate ( =1)	Non-volatile (N/A).
Vapor Density (Air=1)	N/A		
Solubility in Water	Insoluble.		
Appearance & Odor	Bluish, silvery, gray soft metal, granular, shot, sheet, foil; no odor.		

### SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used)	Non-flammable.	Flammable Limits in Air % by Volume	N/A	Lower	Upper
Extinguisher Media	Dry chemical or carbon dioxide should be used on surrounding fire. Do not use water on fires where molten metal is present.				

#### SPECIAL FIREFIGHTING PROCEDURES

In fire conditions, wear a NIOSH/MSHA-approved self-contained breathing apparatus and full protective clothing.

#### UNUSUAL FIRE AND EXPLOSION HAZARDS

When heated emits toxic fumes of lead which can react vigorously with oxidizing materials.

### SECTION V HEALTH HAZARD DATA LL0070

**Threshold Limited Value** Lead as inorganic compounds, as Pb: TWA 0.05 mg/m<sup>3</sup> (ACGIH 2001).

**Effects of Overexposure** Suspect cancer hazard. **SKIN:** Not absorbed through skin. **EYES:** No specific hazard known. Contact may cause transient irritation. **INGESTION:** May produce anorexia, vomiting, malaise, convulsions due to increased intracranial pressure. **INHALATION:** Of dust or fumes can cause lead poisoning. Risk of cancer depends on level and duration of exposure. Target organs: Lungs, kidneys.

**Emergency and First Aid Procedures** **INGESTION:** Call physician or Poison Control Center immediately. Induce vomiting only if advised by appropriate medical personnel. Never give anything by mouth to an unconscious person. **EYES:** Check for and remove contact lenses. Flush thoroughly with water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get immediate medical attention. **SKIN:** Remove contaminated clothing. Flush thoroughly with mild soap and water. If irritation occurs, get medical attention. **INHALATION:** Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

### SECTION VI REACTIVITY DATA

Stability	Unstable		Conditions to Avoid	High temperatures to produce fumes.
	Stable	X		

**Incompatibility (Materials to Avoid)** Strong oxidizing materials.

**Hazardous Decomposition Products** When heated, emits toxic fumes of lead.

<b>Hazardous Polymerization</b>		<b>Conditions to Avoid</b>
May Occur	Will Not Occur	Not applicable.
	X	

### SECTION VII SPILL OR LEAK PROCEDURES

**Steps to be taken in case material is released or spilled** Carefully sweep up without producing dust and recycle for use or place in a suitable container for disposal.

**Waste Disposal Method** Discharge, treatment, or disposal may be subject to Federal, State or Local laws. These disposal guidelines are intended for the disposal of catalog-size quantities only.

Dispose of in an approved chemical landfill or contract with a licensed waste disposal service.

### SECTION VIII SPECIAL PROTECTION INFORMATION

**Respiration Protection (Specify Type)** None should be needed in normal laboratory use at room temperature. If dusty conditions prevail, work in ventilation hood or wear a NIOSH/MSHA-approved dust mask or respirator.

Ventilation	Local Exhaust	None needed.	Special	No.
	Mechanical (General)	None needed.	Other	No.

**Protective Gloves** Recommended - leather. **Eye Protection** Chemical safety glasses.

**Other Protective Equipment** Smock, apron, eye wash station, lab coat, ventilation hood.

### SECTION IX SPECIAL PRECAUTIONS

**Precautions to be Taken in Handling & Storing** Store in a cool, dry place away from fire hazards. Wash thoroughly after handling. Remove and wash contaminated clothing.

**Other Precautions** Read label on container before using. Do not wear contact lenses when working with chemicals. For laboratory use only. Not for drug, food or household use. Keep out of reach of children.

Lead can react violently with oxidizing materials. Water may become trapped within surface cracks which may cause an explosion when the metal is molten.

**WARNING: THIS PRODUCT CONTAINS A CHEMICAL KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.**

Revision No. 10 Date 01/12/07 Approved James A. Bertsch Chemical Safety Coordinator JAB

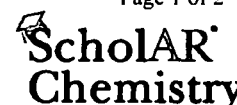
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D.O.T. Non Regulated.

Approved by U.S. Department of Labor "essentially similar" to form OSHA-20

MSDS # 426.20

# Magnesium Metal

Scholar  
Chemistry**Section 1: Product and Company Identification****Magnesium Metal****Synonyms/General Names:** N/A**Product Use:** For educational use only**Manufacturer:** Columbus Chemical Industries, Inc., Columbus, WI 53925.**24 Hour Emergency Information Telephone Numbers****CHEMTREC (USA):** 800-424-9300**CANUTEC (Canada):** 613-424-6666

Scholar Chemistry; 5100 W. Henrietta Rd, Rochester, NY 14586; (866) 260-0501; www.Scholarchemistry.com

**Section 2: Hazards Identification***Silver metal chips, granules, ribbon, turnings, no odor***WARNING!** Flammable solid, dangerous when wet.

Flammable solid, keep away from all ignition sources. Contact with water produces flammable gas.

Target organs: Skin, eyes and respiratory system.

**HMIS (0 to 4)**

<b>Health</b>	<b>1</b>
<b>Fire Hazard</b>	<b>2</b>
<b>Reactivity</b>	<b>2</b>

This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

**Section 3: Composition / Information on Ingredients**

Magnesium (7439-95-4), &gt;99%

**Section 4: First Aid Measures***Always seek professional medical attention after first aid measures are provided.***Eyes:** Immediately flush eyes with excess water for 15 minutes, lifting lower and upper eyelids occasionally.**Skin:** Immediately flush skin with excess water for 15 minutes while removing contaminated clothing.**Ingestion:** Call Poison Control immediately. Rinse mouth with cold water. Give victim 1-2 tbsp of activated charcoal mixed with 8 oz water.**Inhalation:** Remove to fresh air. If not breathing, give artificial respiration.**Section 5: Fire Fighting Measures**

Flammable solid. When heated to decomposition, emits acrid fumes

**Protective equipment and precautions for firefighters:** Do Not Use carbon dioxide, foam, water or halogenated extinguishing agents. Use class D extinguisher or smother with dry sand, dry clay, dry ground limestone or dry graphite. Firefighters should wear full fire fighting turn-out gear and respiratory protection (SCBA).

Material is not sensitive to mechanical impact or static discharge.

**Section 6: Accidental Release Measures**

Use personal protection recommended in Section 8. Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Remove all ignition sources and ventilate area. Sweep up spill and place material in a dry container for disposal. See Section 13 for disposal information.

**Section 7: Handling and Storage****Red****Handling:** Use with adequate ventilation and do not breathe dust or vapor. Avoid contact with skin, eyes, or clothing. Wash hands thoroughly after handling.**Storage:** Store in Flammable Area [Red Storage] with other flammable materials and away from any strong oxidizers. Store in a dedicated flammables cabinet. Store in a cool, dry, well-ventilated, locked store room away from incompatible materials.**Section 8: Exposure Controls / Personal Protection**

Use ventilation to keep airborne concentrations below exposure limits. Have approved eyewash facility, safety shower, and fire extinguishers readily available. Wear chemical splash goggles and chemical resistant clothing such as gloves and aprons. Wash hands thoroughly after handling material and before eating or drinking. Use NIOSH-approved respirator with a dust cartridge. Exposure guidelines: Magnesium: OSHA PEL: N/A and ACGIH TLV: N/A, STEL: N/A.

## Section 9: Physical and Chemical Properties

<b>Molecular formula</b>	Mg.	<b>Appearance</b>	Silver metal chips, granules, or turnings.
<b>Molecular weight</b>	24.31.	<b>Odor</b>	No odor.
<b>Specific Gravity</b>	1.74 g/mL @ 20°C.	<b>Odor Threshold</b>	N/A.
<b>Vapor Density (air=1)</b>	N/A.	<b>Solubility</b>	Acids.
<b>Melting Point</b>	651°C.	<b>Evaporation rate</b>	N/A. ( <i>Butyl acetate</i> = 1).
<b>Boiling Point/Range</b>	1107°C.	<b>Partition Coefficient</b>	N/A. ( <i>log P<sub>OW</sub></i> ).
<b>Vapor Pressure (20°C)</b>	N/A.	<b>pH</b>	N/A.
<b>Flash Point:</b>	N/A.	<b>UEL</b>	N/A.
<b>Autoignition Temp.:</b>	473°C (883°F).	<b>LEL</b>	N/A.

N/A = Not available or applicable

## Section 10: Stability and Reactivity

Avoid heat and ignition sources

**Stability:** Stable under normal conditions of use.

**Incompatibility:** Water, acids, chlorine, iodine, bromine and oxidizing agents.

**Shelf life:** Indefinite if stored properly.

## Section 11: Toxicology Information

**Acute Symptoms/Signs of exposure:** *Eyes:* Stinging pain, burns, watering of eyes, inflammation of eyelids and conjunctivitis.

Avoid looking at burning magnesium. *Skin:* Irritation, redness, burns. Powdered metal ignites readily on skin causing burns.

**Ingestion:** Nausea, vomiting and headache. **Inhalation:** Rapid irregular breathing, headache, burns to mucous membranes.

Inhalation of dust or fumes causes metal fume fever.

**Chronic Effects:** Repeated/prolonged skin contact may cause dryness or rashes.

**Sensitization:** none expected

*Magnesium: LD50 [oral, rat]; Not Available; LC50 [rat]; Not Available; LD50 Dermal [rabbit]; Not Available*

*Material has not been found to be a carcinogen nor produce genetic, reproductive, or developmental effects.*

## Section 12: Ecological Information

**Ecotoxicity (aquatic and terrestrial):**

Ecological impact has not been determined

## Section 13: Disposal Considerations

Check with all applicable local, regional, and national laws and regulations. Local regulations may be more stringent than regional or national regulations. Use a licensed chemical waste disposal firm for proper disposal.

## Section 14: Transport Information

<b>DOT Shipping Name:</b>	Magnesium.	<b>Canada TDG:</b>	Magnesium.
<b>DOT Hazard Class:</b>	4.1, pg III.	<b>Hazard Class:</b>	4.1, pg III.
<b>Identification Number:</b>	UN1869.	<b>UN Number:</b>	UN1869.

## Section 15: Regulatory Information

**EINECS:** Listed (231-104-6).

**WHMIS Canada:** B4, B6: Flammable solid, Reactive flammable material.

**TSCA:** All components are listed or are exempt.

**California Proposition 65:** Not listed.

*The product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.*

## Section 16: Other Information

**Current Issue Date:** January 23, 2009

*Disclaimer: Scholar Chemistry and Columbus Chemical Industries, Inc., ("S&C") believes that the information herein is factual but is not intended to be all inclusive. The information relates only to the specific material designated and does not relate to its use in combination with other materials or its use as to any particular process. Because safety standards and regulations are subject to change and because S&C has no continuing control over the material, those handling, storing or using the material should satisfy themselves that they have current information regarding the particular way the material is handled, stored or used and that the same is done in accordance with federal, state and local law. S&C makes no warranty, expressed or implied, including (without limitation) warranties with respect to the completeness or continuing accuracy of the information contained herein or with respect to fitness for any particular use.*

# Material Safety Data Sheet

## Manganese metal

ACC# 88704

### Section 1 - Chemical Product and Company Identification

**MSDS Name:** Manganese metal

**Catalog Numbers:** M78

**Synonyms:** Colloidal manganese; Magnacat

**Company Identification:**

Fisher Scientific

1 Reagent Lane

Fair Lawn, NJ 07410

**For information, call:** 201-796-7100

**Emergency Number:** 201-796-7100

**For CHEMTREC assistance, call:** 800-424-9300

**For International CHEMTREC assistance, call:** 703-527-3887

### Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7439-96-5	Manganese	100%	231-105-1

### Section 3 - Hazards Identification

#### EMERGENCY OVERVIEW

**Appearance:** reddish-gray or silvery solid.

**Caution!** Causes respiratory tract irritation. Causes eye and skin irritation. May cause digestive tract irritation. Moisture sensitive.

**Target Organs:** Central nervous system.

#### Potential Health Effects

**Eye:** Causes eye irritation.

**Skin:** Causes skin irritation.

**Ingestion:** May cause gastrointestinal irritation with nausea, vomiting and diarrhea.

**Inhalation:** May cause irritation of the respiratory tract with burning pain in the nose and throat, coughing, wheezing, shortness of breath and pulmonary edema. May cause motor incoordination and speech abnormalities.

**Chronic:** Prolonged or repeated inhalation of dusts may cause neurological damage. May cause reproductive and fetal effects.



## Section 4 - First Aid Measures

**Eyes:** Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

**Skin:** Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

**Ingestion:** If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid immediately.

**Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Dusts may be combustible when exposed to heat, flame, or oxidizing agents.

**Extinguishing Media:** Use dry chemical to fight fire. DO NOT USE WATER!

**Flash Point:** Not available.

**Autoignition Temperature:** Not available.

**Explosion Limits, Lower:** Not available.

**Upper:** Not available.

**NFPA Rating:** (estimated) Health: 2; Flammability: 1; Instability:

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:** Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Avoid ingestion and inhalation. Use only in a chemical fume hood.

**Storage:** Store in a tightly closed container. Keep under a nitrogen blanket.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use only under a chemical fume hood.

**Exposure Limits**

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Manganese	0.2 mg/m3 TWA	1 mg/m3 TWA (fume) 500 mg/m3 IDLH	5 mg/m3 Ceiling (fume)

**OSHA Vacated PELs:** Manganese: 1 mg/m3 TWA (fume)

**Personal Protective Equipment**

**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin:** Wear appropriate protective gloves to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to prevent skin exposure.

**Respirators:** Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

## Section 9 - Physical and Chemical Properties

**Physical State:** Solid

**Appearance:** reddish-gray or silvery

**Odor:** None reported.

**pH:** Not available.

**Vapor Pressure:** 1 mm Hg @ 1292C

**Vapor Density:** Not available.

**Evaporation Rate:** Not available.

**Viscosity:** Not available.

**Boiling Point:** 1900 deg C

**Freezing/Melting Point:** 1260 deg C

**Decomposition Temperature:** Not available.

**Solubility:** Insoluble in water.

**Specific Gravity/Density:** 7.20

**Molecular Formula:** Mn

**Molecular Weight:** 54.938

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.

**Conditions to Avoid:** Incompatible materials, dust generation, moisture, excess heat.

**Incompatibilities with Other Materials:** Acids; bases; moisture; halogens; phosphorous and sulfur oxides.

**Hazardous Decomposition Products:** No data available.

**Hazardous Polymerization:** Has not been reported

## Section 11 - Toxicological Information

**RTECS#:****CAS#** 7439-96-5: 009275000**LD50/LC50:****CAS#** 7439-96-5:

Draize test, rabbit, eye: 500 mg/24H Mild;

Draize test, rabbit, skin: 500 mg/24H Mild;

Oral, rat: LD50 = 9 gm/kg;

**Carcinogenicity:****CAS#** 7439-96-5: Not listed by ACGIH, IARC, NTP, or CA Prop 65.**Epidemiology:** No data available.**Teratogenicity:** No data available.**Reproductive Effects:** No data available.**Mutagenicity:** No data available.**Neurotoxicity:** No data available.**Other Studies:****Section 12 - Ecological Information**

No information available.

**Section 13 - Disposal Considerations**

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.**RCRA U-Series:** None listed.**Section 14 - Transport Information**

	US DOT	Canada TDG
Shipping Name:	Not regulated as a hazardous material	No information available.
Hazard Class:		
UN Number:		
Packing Group:		

**Section 15 - Regulatory Information**

## **US FEDERAL**

### **TSCA**

CAS# 7439-96-5 is listed on the TSCA inventory.

### **Health & Safety Reporting List**

None of the chemicals are on the Health & Safety Reporting List.

### **Chemical Test Rules**

None of the chemicals in this product are under a Chemical Test Rule.

### **Section 12b**

None of the chemicals are listed under TSCA Section 12b.

### **TSCA Significant New Use Rule**

None of the chemicals in this material have a SNUR under TSCA.

### **CERCLA Hazardous Substances and corresponding RQs**

None of the chemicals in this material have an RQ.

### **SARA Section 302 Extremely Hazardous Substances**

None of the chemicals in this product have a TPQ.

### **Section 313**

This material contains Manganese (CAS# 7439-96-5, 100%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

### **Clean Air Act:**

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

### **Clean Water Act:**

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

### **OSHA:**

None of the chemicals in this product are considered highly hazardous by OSHA.

### **STATE**

CAS# 7439-96-5 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

### **California Prop 65**

California No Significant Risk Level: None of the chemicals in this product are listed.

## **European/International Regulations**

### **European Labeling in Accordance with EC Directives**

#### **Hazard Symbols:**

XI

#### **Risk Phrases:**

R 2 Risk of explosion by shock, friction, fire or other sources of ignition.

R 36/37/38 Irritating to eyes, respiratory system and skin.

R 48 Danger of serious damage to health by prolonged exposure.

#### **Safety Phrases:**

S 36/37/39 Wear suitable protective clothing, gloves and eye/face protection.

### **WGK (Water Danger/Protection)**

CAS# 7439-96-5: No information available.

### **Canada - DSL/NDSL**

CAS# 7439-96-5 is listed on Canada's DSL List.

**Canada - WHMIS**

This product has a WHMIS classification of D2B.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

**Canadian Ingredient Disclosure List**

CAS# 7439-96-5 is listed on the Canadian Ingredient Disclosure List.

**Section 16 - Additional Information**

**MSDS Creation Date:** 9/02/1997

**Revision #3 Date:** 10/03/2005

*The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.*



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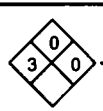
MSDS No.: MM0320  
Effective Date: January 12, 2007

# MATERIAL SAFETY DATA SHEET

## SECTION I NAME

Product	Mercury Metal
Chemical Synonyms	Quick Silver
Formula	Hg
Unit Size	up to 500 g.
C.A.S. No.	7439-97-6

## 24 HOUR EMERGENCY ASSISTANCE

 <b>CHEMTREC</b> 800-424-9300 Day 585-226-6177	<table><tr><td>Health</td><td>4</td></tr><tr><td>Fire</td><td>0</td></tr><tr><td>Reactivity</td><td>1</td></tr></table>	Health	4	Fire	0	Reactivity	1
Health	4						
Fire	0						
Reactivity	1						
<b>NFPA</b> HAZARD RATING MINIMAL SLIGHT MODERATE SERIOUS SEVERE 0 1 2 3 4	<b>HMIS *</b>						

## SECTION II INGREDIENTS OF MIXTURES

Principal Component(s)	%	TLV Units
Mercury metal	100%	See Section V.

**DANGER! CORROSIVE! HARMFUL IF INHALED OR**

**ABSORBED THROUGH SKIN. VAPOR HIGHLY TOXIC.**

## SECTION III PHYSICAL DATA

Melting Point (°F)	-30°C (-38°F)	Specific Gravity (H <sub>2</sub> O = 1)	13.6
Boiling Point (°F)	357°C (674°F)	Percent Volatile by Volume (%)	100%
Vapor Pressure (mm Hg)	0.002 mm @ 25°C	Evaporation Rate (=1)	N/A
Vapor Density (Air=1)	7.0		
Solubility in Water	Insoluble.		
Appearance & Odor	Silver-white, heavy mobile metallic liquid; no odor.		

## SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used)	Non-flammable.	Flammable Limits in Air % by Volume	N/A	Lower	Upper
Extinguisher Media	Use any media suitable for extinguishing supporting fire.				

## SPECIAL FIREFIGHTING PROCEDURES

In fire conditions, wear a NIOSH/MSHA-approved self-contained breathing apparatus and full protective clothing. Mercury is non-flammable and non-explosive in air.

(2004 EMERGENCY RESPONSE GUIDEBOOK, RSPA P. 5800.9, GUIDE PAGE NO. 172)

## UNUSUAL FIRE AND EXPLOSION HAZARDS

Dangerous, when heated mercury evaporates to yield highly toxic fumes of mercury.

D.O.T. Mercury, 8, UN2809, PG III, RQ ≤ 1 lb.

Approved by U.S. Department of Labor "essentially similar" to form OSHA-20

## SECTION V HEALTH HAZARD DATA

MM0320

### Threshold Limited Value

TWA: 0.025 mg/m<sup>3</sup> as Hg elemental and inorganic compounds. (ACGIH 2001).  
Human, oral LDLO 1429 mg/kg.

### Effects of Overexposure

If the mercury in a small clinical thermometer were dispersed in a closed 100' x 100' x 15' room, the TLV would be exceeded. Unsafe conditions are not indicated by odor.

Severe poisoning can occur with less than two hours exposure to high concentrations of vapor. Mercury may be absorbed slowly through the skin. Repeated or prolonged contacts may result in poisoning. A single ingestion of a small amount of pure metallic mercury would not be expected to cause severe injury. However, if the mercury contained mercury compounds, poisoning could result. In all cases of overexposure to mercury, get medical attention!! Target organs: Central nervous system, liver, kidneys.

### Emergency and First Aid Procedures

**INGESTION:** Call physician or Poison Control Center immediately. Induce vomiting only if advised by appropriate medical personnel. Never give anything by mouth to an unconscious person. **EYES:** Check for and remove contact lenses. Flush thoroughly with water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get immediate medical attention. **SKIN:** Remove contaminated clothing. Flush thoroughly with mild soap and water. If irritation occurs, get medical attention. **INHALATION:** Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

## SECTION VI REACTIVITY DATA

Stability	Unstable		Conditions to Avoid	Will react slowly with oxygen when heated and it reacts with halogens. Excessive temperature.
	Stable	X		
Incompatibility (Materials to Avoid)		Acetylinic compounds, ammonia, boron, diiodphosphide, ethylene oxide, metals, methyl azide, methylsilane, oxygen, oxidants, nitric acid, tetracarbonylnickel, nitromethane, silver perchlorate.		
Hazardous Decompositon Products			Thermal decomposition products include toxic mercury vapors and oxygen.	
Hazardous Polymerization			Conditions to Avoid	Not applicable.
May Occur	Will Not Occur			
	X			

## SECTION VII SPILL OR LEAK PROCEDURES

**Steps to be taken in case material is released or spilled**  
Collect all droplets and pools at once by means of suction pump and aspirator bottle with a long capillary tube. Cover fine droplets in non-accessible cracks with calcium polysulfide and excess sulfur. Combine all contaminated mercury in a tightly stoppered bottle. Clean and recycle.

**Waste Disposal Method**  
Discharge, treatment, or disposal may be subject to Federal, State or Local laws. These disposal guidelines are intended for the disposal of catalog-size quantities only. Mercury can be purified for reuse, or it can be sold to a mercury salvage company when large amounts are involved. Dispose of in an approved chemical landfill or contract with a licensed waste disposal service.

## SECTION VIII SPECIAL PROTECTION INFORMATION

Respiration Protection (Specify Type)	Work in a fume hood or wear NIOSH/MSHA-approved respirator with mercury cartridge.		
Ventilation	Local Exhaust	Acceptable.	Special
	Mechanical (General)	Preferred.	Other
Protective Gloves	Rubber, Plastic.	Eye Protection	Chemical safety glasses.

Other Protective Equipment  
Goggles, smock, apron, eye wash station, ventilation hood, proper gloves.

## SECTION IX SPECIAL PRECAUTIONS

**Precautions to be Taken in Handling & Storing**  
Store in a cool, dry place away from fire hazards. Clean up all spills at once. Wash thoroughly after handling.

**Other Precautions**  
Read label on container before using. Do not wear contact lenses when working with chemicals. For laboratory use only. Not for drug, food or household use. Keep out of reach of children.

Do not breathe Mercury fumes. Mercury should not be heated without proper precautions to safely handle highly toxic mercury vapor. Remove and wash contaminated clothing.

Revision No. 9 Date 01/12/07 Approved James A. Bertsch Chemical Safety Coordinator JAB

The information contained herein is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees. \* Hazardous Materials Industrial Standards. Printed on recycled paper.

# Material Safety Data Sheet

## Nickel Metal

ACC# 16240

### Section 1 - Chemical Product and Company Identification

**MSDS Name:** Nickel Metal

**Catalog Numbers:** N40-500

**Synonyms:**

**Company Identification:**

Fisher Scientific

1 Reagent Lane

Fair Lawn, NJ 07410

**For information, call:** 201-796-7100

**Emergency Number:** 201-796-7100

**For CHEMTREC assistance, call:** 800-424-9300

**For International CHEMTREC assistance, call:** 703-527-3887

### Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7440-02-0	NICKEL	100.0	231-111-4

### Section 3 - Hazards Identification

#### EMERGENCY OVERVIEW

Appearance: white to gray white solid.

**Caution!** May cause allergic skin reaction. May cause eye irritation. May cause respiratory tract irritation. May cause cancer in humans. May cause liver and kidney damage.

**Target Organs:** Kidneys, liver, respiratory system.

#### Potential Health Effects

**Eye:** May cause eye irritation.

**Skin:** May cause skin sensitization, an allergic reaction, which becomes evident upon re-exposure to this material. May cause severe irritation and possible burns. May cause dermatitis.

**Ingestion:** Causes gastrointestinal irritation with nausea, vomiting and diarrhea.

**Inhalation:** Inhalation of fumes may cause metal fume fever, which is characterized by flu-like symptoms with metallic taste, fever, chills, cough, weakness, chest pain, muscle pain and increased white blood cell count. Inhalation of a mist of this material may cause respiratory tract irritation. Breathing Nickel (Dust and Fume) can cause a sore or hole in the "bone" (septum) dividing the inner nose.

**Chronic:** Prolonged or repeated skin contact may cause sensitization dermatitis and possible destruction and/or ulceration. May cause respiratory tract cancer.

### Section 4 - First Aid Measures

**Eyes:** Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

**Skin:** Get medical aid if irritation develops or persists. Wash clothing before reuse. Flush skin with plenty of soap and water.

**Ingestion:** If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

**Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid if cough or other symptoms appear.

**Notes to Physician:** Treat symptomatically and supportively.

**Antidote:** There exists several chelation agents. The determination of their use should be made only by qualified medical personnel.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Dusts at sufficient concentrations can form explosive mixtures with air. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Dust can be an explosion hazard when exposed to heat or flame.

**Extinguishing Media:** Confining and smothering is preferable to applying water. DO NOT USE WATER, CO<sub>2</sub>, OR FOAM DIRECTLY ON FIRE ITSELF. Use DRY sand, sodium chloride powder, graphite powder, copper powder or Lith-X powder. Dousing metallic fires with water may generate hydrogen gas, an extremely dangerous explosion hazard, particularly if fire is in a confined environment.

**Flash Point:** Not applicable.

**Autoignition Temperature:** Not applicable.

**Explosion Limits, Lower:** Not available.

**Upper:** Not available.

**NFPA Rating:** (estimated) Health: 3; Flammability: 1; Instability: 0

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:** Very fine particles can cause a fire or explosion. Eliminate all ignition sources. Reduce airborne dust and prevent scattering by moistening with water. Sweep up, then place into a suitable container for disposal. Carefully scoop up and place into appropriate disposal container. Provide ventilation.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with skin and eyes. Avoid ingestion and inhalation.

**Storage:** Store in a cool, dry, well-ventilated area away from incompatible substances. Keep containers tightly closed.



## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

### Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
NICKEL	1.5 mg/m <sup>3</sup> TWA (inhalable fraction)	0.015 mg/m <sup>3</sup> TWA 10 mg/m <sup>3</sup> IDLH	1 mg/m <sup>3</sup> TWA

**OSHA Vacated PELs:** NICKEL: 1 mg/m<sup>3</sup> TWA

### Personal Protective Equipment

**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin:** Wear appropriate gloves to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to minimize contact with skin.

**Respirators:** Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

## Section 9 - Physical and Chemical Properties

**Physical State:** Solid

**Appearance:** white to gray white

**Odor:** none reported

**pH:** Not available.

**Vapor Pressure:** 1 mm Hg @ 1810 C

**Vapor Density:** Not available.

**Evaporation Rate:** Not available.

**Viscosity:** Not applicable.

**Boiling Point:** 2730 deg C

**Freezing/Melting Point:** 1455 deg C

**Decomposition Temperature:** Not available.

**Solubility:** Insoluble in water.

**Specific Gravity/Density:** 8.90

**Molecular Formula:** Ni

**Molecular Weight:** 58.69

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.

**Conditions to Avoid:** Incompatible materials, dust generation.

**Incompatibilities with Other Materials:** Acids, aluminum, ammonia, ammonium nitrate, bromine pentafluoride, ethylene + aluminum, dioxane, fluorine, hydrazine, hydrazoic acid, hydrogen, methanol, nitric acid, nitril fluoride, organic solvents, oxidants, phosphorus, potassium perchlorate, selenium, sulfur and compounds.

**Hazardous Decomposition Products:** Toxic and highly flammable nickel carbonyl.

**Hazardous Polymerization:** Has not been reported.

## Section 11 - Toxicological Information

**RTECS#:**

**CAS#** 7440-02-0: QR5950000; QR6126100; QR6555000; QR7120000

**LD50/LC50:**

Not available.

**Carcinogenicity:**

**CAS#** 7440-02-0:

- **ACGIH:** Not listed.
- **California:** carcinogen, initial date 10/1/89
- **NTP:** Suspect carcinogen
- **IARC:** Group 1 carcinogen (listed as Nickel compounds).

**Epidemiology:** Epidemiological studies have shown an increased incidence of cancers among nickel refinery workers.

**Teratogenicity:** No information available.

**Reproductive Effects:** No information available.

**Mutagenicity:** No information available.

**Neurotoxicity:** No information available.

**Other Studies:**

## Section 12 - Ecological Information

**Ecotoxicity:** No data available. No information available.

**Environmental:** No information reported.

**Physical:** No information available.

**Other:** None.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.

**RCRA U-Series:** None listed.

## Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	Not regulated as a hazardous material	No information available.
Hazard Class:		
UN Number:		
Packing Group:		

## Section 15 - Regulatory Information

### US FEDERAL

#### TSCA

CAS# 7440-02-0 is listed on the TSCA inventory.

#### Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

#### Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

#### Section 12b

None of the chemicals are listed under TSCA Section 12b.

#### TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

#### CERCLA Hazardous Substances and corresponding RQs

CAS# 7440-02-0: 100 lb final RQ (no reporting of releases of this hazardous substance is required)

#### SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

#### SARA Codes

CAS # 7440-02-0: immediate, delayed, fire.

#### Section 313

This material contains NICKEL (CAS# 7440-02-0, 100.0%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

#### Clean Air Act:

CAS# 7440-02-0 (listed as Nickel compounds) is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

#### Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

CAS# 7440-02-0 is listed as a Priority Pollutant under the Clean Water Act. CAS# 7440-02-0 is listed as a Toxic Pollutant under the Clean Water Act.

#### OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

#### STATE

CAS# 7440-02-0 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

#### California Prop 65

#### The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains NICKEL, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: None of the chemicals in this product are listed.

#### European/International Regulations

#### European Labeling in Accordance with EC Directives

#### Hazard Symbols:

XN

#### Risk Phrases:

R 40 Limited evidence of a carcinogenic effect.

R 43 May cause sensitization by skin contact.

**Safety Phrases:**

S 22 Do not breathe dust.

S 36 Wear suitable protective clothing.

**WGK (Water Danger/Protection)**

CAS# 7440-02-0: No information available.

**Canada - DSL/NDSL**

CAS# 7440-02-0 is listed on Canada's DSL List.

**Canada - WHMIS**

This product has a WHMIS classification of D2A.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

**Canadian Ingredient Disclosure List**

CAS# 7440-02-0 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information
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**MSDS Creation Date:** 3/19/1998

**Revision #5 Date:** 10/28/2008

*The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.*

## MATERIAL SAFETY DATA SHEET

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A. D. MACKAY, Inc.  
10 NORTH BROADWAY  
P.O. BOX 'G'  
RED HOOK, N.Y. 12571-0046  
(914) 758-1033

## SECTION I

FEBRUARY 2006 REVISED

MATERIAL NAME:  
VANADIUM (METAL, LUMP, POWDER, Etc.)  
MATERIAL FAMILY:  
PURE ELEMENT  
TSCA:

CAS #: 7440-62-2  
EMERGENCY TELEPHONE NO.  
1-800-424-2300 (24 HOURS)  
FORMULA: UN I.D.#:  
V NOT CLASSIFIED

THIS PRODUCT IS LISTED ON THE TOXIC SUBSTANCES CONTROL ACT (TSCA) INVENTORY.

## SECTION II - HAZARDOUS INGREDIENTS

TYPICAL COMPOSITION	%	OSHA/PEL*	ACGIH/TLV*
VANADIUM	>99%	0.5 (CEILING), 0.1 (FUME)	0.5

\*NONE FOR METAL. THESE VALUES REPRESENT  $V_2O_5$  AS V ( $mc/m^3$ ).

## SECTION III - PHYSICAL DATA

BOILING POINT	MELTING POINT	SPECIFIC GRAVITY ( $H_2O=1$ )
3380°C	1890°C	5.96
VAPOR PRESSURE (mm Hg.)	VAPOR DENSITY (AIR=1)	PERCENT VOLATILE BY VOLUME
N/A	N/A	NONVOLATILE
SOLUBILITY IN WATER	BULK DENSITY	EVAPORATION RATE
INSOLUBLE	370 lb/ft <sup>3</sup>	N/A
APPEARANCE AND ODOR		AUTOIGNITION TEMPERATURE
LIGHT GRAY OR BLACK LUSTROUS POWDER. OR SILVER GRAY METAL. NO ODOR.		POWDER CAN BE IGNITED AT 500°C

## OTHER COMMENTS:

NOT ATTACKED BY HOT OR COLD HCl. BY COLD  $H_2SO_4$ . SOLUBLE IN HOT  $H_2SO_4$ . IN HYDROFLUORIC ACID. IN NITRIC ACID. IN AQUA REGIA. SLOWLY OXIDIZES IF EXPOSED TO AIR. FORMS  $V_2O_5$  ABOVE 400°C. THE SOLID METAL WILL NOT BURN.

## SECTION IV - FIRE AND EXPLOSION DATA

FLASH POINT: N/A  
FLAMMABLE LIMITS: N/A

## EXTINGUISHING MEDIA:

CLASS 'D' AGENT SUCH AS ANSUL'S MET-L-X DRY POWDER FOR METAL FIRES.

## SPECIAL FIRE FIGHTING PROCEDURES:

WEAR NIOSH/MSHA APPROVED SELF-CONTAINED BREATHING APPARATUS FOR FIGHTING LARGE SCALE FIRES. FIRE CAN BE CONTROLLED BY SMOTHERING WITH DRY TABLE SALT OR USING TYPE D FIRE EXTINGUISHER MATERIAL. DO NOT CONTACT METAL WITH WATER.

## UNUSUAL FIRE AND EXPLOSION HAZARDS:

DUST MAY BE HAZARDOUS WHEN EXPOSED TO HEAT OR FLAME. HOT OR BURNING METAL CAN PRODUCE TOXIC FUMES. USE SELF-CONTAINED BREATHING APPARATUS OPERATED IN POSITIVE PRESSURE MODE IF THE FIRE INVOLVED VANADIUM METAL OR OXIDE.

## SECTION V - HEALTH HAZARD DATA

## THRESHOLD LIMIT VALUE:

NONE FOR METAL. 0.5  $mg/m^3$  FOR  $V_2O_5$  AS V.

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# MATERIAL SAFETY DATA SHEET

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MATERIAL: VANADIUM

CONTINUED

A.D. MACKAY, Inc.

## SECTION V - HEALTH HAZARD DATA CONTINUED

### TOXICITY DATA:

METALLIC VANADIUM IS CONSIDERED NON-TOXIC. HOWEVER, VANADIUM COMPOUNDS, NOTABLY THE PENTOXIDE AND METAVANADATE, ARE HIGHLY TOXIC. FINELY-DIVIDED VANADIUM IS REACTIVE ENOUGH TO CONVERT SLOWLY TO TOXIC FORMS, MAKING CONSIDERATION OF THEIR TOXIC EFFECTS NECESSARY. TOXICITY DATA IS FOR SOLUBLE COMPOUNDS. AS METAL: NON-TOXIC. AS  $V_2O_5$ : INHALATION-RAT  $LC_{50}$ : 70  $mg/m^3/2HR$ . INHALATION-HUMAN  $TCLo$ : 1  $mg/m^3/8HR$ . - ALLERGIC REACTION. ORAL - RAT  $LD_{50}$ : 10  $mg/kg$ .

### CARCINOGENICITY:

NTP? NO. IARC MONOGRAPHS? NO. OSHA REGULATED? NO.

### ROUTES OF ENTRY:

INHALATION: YES. INGESTION: YES. SKIN ABSORPTION: NO. SKIN/EYE

CONTACT: YES.

### TARGET ORGANS:

AS SOLUBLE VANADIUM COMPOUNDS: LUNGS, LIVER, KIDNEY, BONE MARROW, ADRENALS.

EFFECTS OF OVEREXPOSURE: THE PENTOXIDE DUST HAS BEEN REPORTED TO BE A RESPIRATORY IRRITANT AND TO CAUSE SKIN PALLOR, GREENISH-BLACK TONGUE, CHEST PAIN, COUGH, DYSPNEA, PALPITATION, AND LUNG CHANGES. WHEN INGESTED CAUSES GASTRO INTESTINAL DISTURBANCES. ACUTE (AS SOLUBLE VANADIUM COMPOUNDS): IRRITATION OF EYES, NOSE, THROAT AND RESPIRATORY TRACT, BRONCHITIS WITH WHEEZING AND CHEST PAIN. ALSO AFFECTS NERVOUS SYSTEM. CAN CAUSE HEMORRHAGE, PARALYSIS, CONVULSIONS AND RESPIRATORY DEPRESSION (IN SEVERE EXPOSURES). CHRONIC (AS SOLUBLE VANADIUM COMPOUNDS): CHRONIC BRONCHITIS, ALLERGIC SKIN REACTION. CHRONIC OBSTRUCTION PULMONARY DISEASE.

### MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE:

NO DATA

### EMERGENCY AND FIRST AID PROCEDURES:

INHALATION: AS METAL POWDER OR AS  $V_2O_5$ , REMOVE TO FRESH AIR. GIVE OXYGEN IF BREATHING IS DIFFICULT. PERFORM CPR AS NECESSARY. TREAT FOR SHOCK. SEEK IMMEDIATE MEDICAL ATTENTION. EYE CONTACT: AS METAL POWDER OR  $V_2O_5$ , FLUSH EYES IMMEDIATELY WITH WATER FOR AT LEAST 15 MINUTES. SEEK IMMEDIATE MEDICAL ATTENTION. SKIN CONTACT: REMOVE CONTAMINATED CLOTHING. WASH AFFECTED AREA THOROUGHLY WITH SOAP OR MILD DETERGENT AND WATER. SEEK IMMEDIATE MEDICAL ATTENTION. INGESTION: SEEK IMMEDIATE MEDICAL ATTENTION.

NOTES TO PHYSICIAN (INCLUDING ANTIDOTES): INHALATION OR INGESTION OF METALLIC VANADIUM (AS POWDER) POSES NO THREAT AS SUCH. THE MATERIAL COULD REACT WITH BODY FLUIDS, HOWEVER, TO PRODUCE TOXIC COMPOUNDS IN SITU. CALCIUM DISODIUM EDTA HAS BEEN SHOWN TO BE ANTIDOTAL IN ANIMAL STUDIES OF VANADIUM COMPOUNDS. ASCORBIC ACID WAS BENEFICIAL IN STUDIES OF VANADIUM IN HUMANS. OTHER TREATMENT SHOULD BE DIRECTED TO RELIEF OF SYMPTOMS, PRIMARILY RELATED TO THE IRRITATION OF MUCOUS MEMBRANES. INHALATION OF TOXIC LEVELS OF VANADIUM COMPOUNDS MAY CAUSE INCREASED SUSCEPTIBILITY TO RESPIRATORY INFECTION.

## SECTION VI - REACTIVITY DATA

STABILITY Unstable | CONDITIONS TO AVOID:  
Stable | XXX HEAT, SPARKS AND OPEN FLAMES.

### INCOMPATIBILITY (materials to avoid)

POWDER OXIDIZES SLOWLY IF EXPOSED TO AIR, FORMS  $V_2O_5$  ABOVE 400°C. VANADIUM SHOULD BE KEPT AWAY FROM OXIDIZERS. VANADIUM WILL REACT VIOLENTLY WITH CHLORINE ABOVE 180°C. IS READILY DISSOLVED BY NITRIC ACID AND SLOWLY OXIDIZES IF THE SURFACE IS MOIST. POWDER EXPLODES ON CONTACT AT 0°C WITH LIQUID  $Cl_2$  AND CAUSES INCANDESCENCE WITH  $Br_2$ .

### HAZARDOUS DECOMPOSITION PRODUCTS:

NONE KNOWN

HAZARDOUS MAY OCCUR | CONDITIONS TO AVOID:  
POLYMER- WON'T OCCUR | XXX N/A  
IZATION |

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# M A T E R I A L   S A F E T Y   D A T A   S H E E T

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MATERIAL: VANADIUM

CONTINUED

A.D. MACKAY, Inc.

## SECTION VII - SPILL OR LEAK PROCEDURE

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:

USE NORMAL CLEAN-UP PROCEDURES WHICH MINIMIZE EXPOSURE IS APPLICABLE. DO NOT CAUSE DUSTS TO FORM. SEGREGATE MATERIAL. SWEEP UP OR VACUUM AND DISPOSE.

WASTE DISPOSAL METHOD:

CONSULT FEDERAL, STATE OR LOCAL AUTHORITIES FOR PROPER 'DISPOSAL' PROCEDURES

## SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (specify type)

FOR OPERATIONS SUCH AS GRINDING OR POLISHING, WHICH WILL PRODUCE DUSTS OF METAL POWDER OR OXIDE ABOVE 0.5 mg/m<sup>3</sup>: IN CONCENTRATIONS LESS THAN 25 mg/m<sup>3</sup>: A HIGH EFFICIENCY PARTICULATE FILTER RESPIRATOR WITH A FULL FACEPIECE. IN CONCENTRATIONS LESS THAN 70 mg/m<sup>3</sup>: A POWDERED AIR-PURIFYING RESPIRATOR WITH A FULL FACEPIECE AND A HIGH EFFICIENCY PARTICULATE FILTER. IN CONCENTRATIONS GREATER THAN 70 mg/m<sup>3</sup>: SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE. USE ONLY NIOSH/MSHA APPROVED EQUIPMENT.

VENTILATION	LOCAL EXHAUST RECOMMENDED - FUME	SPECIAL
	HOOD FOR DUSTS OR FUMES	N/A
	MECHANICAL (general)	OTHER
	RECOMMENDED	N/A

PROTECTIVE GLOVES

MSHA/NIOSH APPROVED RUBBER GLOVES

EYE PROTECTION: MSHA/NIOSH  
APPROVED EYE GOGGLES/MASK

OTHER PROTECTIVE EQUIPMENT:

WORK UNIFORM, NON-FLAMMABLE, WITHOUT POCKETS AND CUFFS. NORMAL LABORATORY WEAR. EYEWASH STATION CAPABLE OF SUSTAINED FLUSHING.

## SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING:

STORE IN AN INERT ATMOSPHERE TO PREVENT OXIDIZATION, SUCH AS ARGON GAS. KEEP MATERIAL DRY. IF MACHINING CHIPS OR RESIDUES HAVE DEVELOPED A GREEN-BLACK OXIDE SURFACE FILM, THIS OXIDE SHOULD BE CAREFULLY REMOVED BY PICKLING BEFORE FURTHER HANDLING OR PROCESSING OF THE METAL. FINELY GROUND MATERIAL SHOULD BE KEPT FROM HEAT, SPARKS AND FLAMES.

OTHER PRECAUTIONS:

WASH THOROUGHLY AFTER USAGE. CHANGE FROM WORK UNIFORM TO STREET CLOTHING PRIOR TO LEAVING WORK AREAS. CLEANLINESS AND GOOD HOUSEKEEPING ARE IMPORTANT TO MINIMIZE OXIDE DUST LEVELS. EATING AND SMOKING SHOULD NOT BE PERMITTED IN AREAS WHERE VANADIUM DUSTS ARE PRESENT. WASH HANDS THOROUGHLY BEFORE EATING, SMOKING, OR USING TOILET FACILITIES.

REMEMBER -- SAFETY IS -- NO ACCIDENT

A NOTE CONCERNING HANDLING AND PRECAUTIONS OF SOME METALS & CHEMICALS, Etc.

Some of the metals and chemicals listed herein are research or experimental substances which may be TOXIC, as defined by various governmental regulations. In accordance with Environmental Protection Agency regulations, these materials should only be handled by, or under the direct supervision of a "TECHNICALLY QUALIFIED INDIVIDUAL," as defined in 40 CFR, par. 710.2(aa).

The above information is accurate to the best of our knowledge. However, since data, safety standards, and government regulations are subject to change and the conditions of handling and use or misuse are beyond our control, A. D. MACKAY, Inc. MAKES NO WARRANTY, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THE COMPLETENESS OR CONTINUING ACCURACY OF THE INFORMATION CONTAINED HEREIN AND DISCLAIMS ALL LIABILITY FOR RELIANCE THEREON. User should satisfy himself that he has all current data relevant to his/her particular use.



GARDENA, CA  
NEW BRUNSWICK, NJ

# Material Safety Data Sheet

NFPA	HMIS	Personal Protective Equipment						
	<table><tr><td>Health Hazard</td><td>1</td></tr><tr><td>Fire Hazard</td><td>0</td></tr><tr><td>Reactivity</td><td>1</td></tr></table>	Health Hazard	1	Fire Hazard	0	Reactivity	1	 See Section 15.
Health Hazard	1							
Fire Hazard	0							
Reactivity	1							

## Section 1. Chemical Product and Company Identification

Page Number: 1

Common Name/ Trade Name	<b>Zinc Metal</b>	Catalog Number(s).	YY053, Z1020, Z1033, Z1035, Z1040, Z1043
		CAS#	7440-66-6
Manufacturer	SPECTRUM LABORATORY PRODUCTS INC. 14422 S. SAN PEDRO STREET GARDENA, CA 90248	RTECS	ZG8600000
		TSCA	TSCA 8(b) inventory: Zinc Metal
Commercial Name(s)	Not available.	CI#	Not applicable.
Synonym	Zinc Metal Sheets; Zinc Metal Shot; Zinc Metal Strips; Zinc Foil	<b>IN CASE OF EMERGENCY</b> <b>CHEMTREC (24hr) 800-424-9300</b>  CALL (310) 516-8000	
Chemical Name	Zinc		
Chemical Family	Metal.		
Chemical Formula	Zn		
Supplier	SPECTRUM LABORATORY PRODUCTS INC. 14422 S. SAN PEDRO STREET GARDENA, CA 90248		

## Section 2 Composition and Information on Ingredients

		Exposure Limits			
Name	CAS #	TWA (mg/m <sup>3</sup> )	STEL (mg/m <sup>3</sup> )	CEL (mg/m <sup>3</sup> )	% by Weight
1) Zinc Metal	7440-66-6				100

Toxicological Data  
on Ingredients

**Zinc Metal**  
LD50: Not available.  
LC50: Not available.

## Section 3. Hazards Identification

Potential Acute Health Effects	Slightly hazardous in case of skin contact (irritant), of ingestion. Non-irritating to the eyes. Non-hazardous in case of inhalation.
Potential Chronic Health Effects	<b>CARCINOGENIC EFFECTS:</b> Not available. <b>MUTAGENIC EFFECTS:</b> Not available. <b>TERATOGENIC EFFECTS:</b> Not available. <b>DEVELOPMENTAL TOXICITY:</b> Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

Continued on Next Page



**Section 4. First Aid Measures**

Eye Contact	Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.
Skin Contact	Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.
Serious Skin Contact	Not available.
Inhalation	If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Serious Inhalation	Not available.
Ingestion	Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.
Serious Ingestion	Not available.

**Section 5. Fire and Explosion Data**

Flammability of the Product	Non-flammable.
Auto-Ignition Temperature	Not applicable.
Flash Points	Not available.
Flammable Limits	Not available.
Products of Combustion	Not available.
Fire Hazards in Presence of Various Substances	Slightly flammable to flammable in presence of oxidizing materials, of acids, of alkalis, of moisture. Non-flammable in presence of shocks.
Explosion Hazards in Presence of Various Substances	Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.
Fire Fighting Media and Instructions	Flammable solid. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.
Special Remarks on Fire Hazards	Zinc + NaOH causes ignition. Oxidation of zinc by potassium proceeds with incandescence. Residues from zinc dust /acetic acid reduction operations may ignite after long delay if discarded into waste bins with paper. Incandescent reaction when Zinc and Arsenic or Tellurium, or Selenium are combined. When hydrazine mononitrate is heated in contact with zinc, a flaming decomposition occurs at temperatures a little above its melting point. Contact with acids and alkali hydroxides (sodium hydroxide, potassium hydroxide, calcium hydroxide, etc.) results in evolution of hydrogen with sufficient heat of reaction to ignite the hydrogen gas. Zinc foil ignites if traces of moisture are present. It is water reactive and produces flammable gases on contact with water. It may ignite on contact with water or moist air.
Special Remarks on Explosion Hazards	Not available.

**Section 6. Accidental Release Measures**

Small Spill	Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.
Large Spill	Flammable solid that, in contact with water, emits flammable gases. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Prevent entry into sewers, basements or confined areas, dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

**Section 7. Handling and Storage**

Precautions	Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, alkalis, moisture.
Storage	Keep container tightly closed. Keep container in a cool, well-ventilated area. Keep from any possible contact with water. Do not allow water to get into container because of violent reaction.

**Section 8. Exposure Controls/Personal Protection**

Engineering Controls	Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.
Personal Protection	Safety glasses. Lab coat. Gloves (impervious).
Personal Protection in Case of a Large Spill	Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.
Exposure Limits	Not available.

**Section 9. Physical and Chemical Properties**

Physical state and appearance	Solid. (Lustrous solid. Metal solid.)	Odor	Not available.
Molecular Weight	65.39 g/mole	Taste	Not available.
pH (1% soln/water)	Not applicable.	Color	Bluish-grey
Boiling Point	907°C (1664.6°F)		
Melting Point	419°C (786.2°F)		
Critical Temperature	Not available.		
Specific Gravity	Not available.		
Vapor Pressure	Not applicable.		
Vapor Density	Not available.		
Volatility	Not available.		
Odor Threshold	Not available.		
Water/Oil Dist. Coeff.	Not available.		
Ionicity (in Water)	Not available.		
Dispersion Properties	Not available.		
Solubility	Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol, acetone.		

**Section 10. Stability and Reactivity Data**

Stability	The product is stable.
Instability Temperature	Not available.
Conditions of Instability	Excess heat, incompatible materials, moisture
Incompatibility with various substances	Reactive with oxidizing agents, acids, alkalis. Slightly reactive to reactive with moisture. The product may react violently with water to emit flammable but non toxic gases.
Corrosivity	Non-corrosive in presence of glass.
Special Remarks on Reactivity	Incompatible with acids, halogenated hydrocarbons, $\text{NH}_4\text{NO}_3$ , barium oxide, $\text{Ba}(\text{NO}_3)_2$ , Cadmium, $\text{CS}_2$ , chlorates, $\text{Cl}_2$ , $\text{CrO}_3$ , $\text{F}_2$ , Hydroxylamine, $\text{Pb}(\text{NO}_3)_2$ , $\text{MnCl}_2$ , $\text{HNO}_3$ , performic acid, $\text{KClO}_3$ , $\text{KNO}_3$ , $\text{N}_2\text{O}_2$ , Selenium, $\text{NaClO}_3$ , $\text{Na}_2\text{O}_2$ , Sulfur, Te, water, $(\text{NH}_4)_2\text{S}$ , $\text{As}_2\text{O}_3$ , $\text{CS}_2$ , $\text{CaCl}_2$ , chlorinated rubber, catalytic metals, halocarbons, o-nitroanisole, nitrobenzene, nonmetals, oxidants, paint primer base, pentacarbonoyliron, transition metal halides, seleninyl bromide, $\text{HCl}$ , $\text{H}_2\text{SO}_4$ , $(\text{Mg} + \text{Ba}(\text{NO}_3)_2 + \text{BaO}_2)$ , (ethyl acetoacetate +tribromoneopentyl alcohol. Contact with Alkali Hydroxides(Sodium Hydroxide, Potassium Hydroxide, Calcium Hydroxide, etc) results in evolution of hydrogen. Ammonium nitrate + zinc + water causes a violent reaction with evolution of steam and zinc oxide. May react with water.
Special Remarks on Corrosivity	Not available.
Polymerization	Will not occur.

**Section 11. Toxicological Information**

Routes of Entry	Inhalation. Ingestion.
Toxicity to Animals	LD50: Not available. LC50: Not available.
Chronic Effects on Humans	Not available.
Other Toxic Effects on Humans	Slightly hazardous in case of skin contact (irritant), of ingestion. Non-hazardous in case of inhalation.
Special Remarks on Toxicity to Animals	Lowest Published Lethal Dose: LDL [Duck] - Route: Oral; Dose: 388 mg/kg
Special Remarks on Chronic Effects on Humans	Not available.
Special Remarks on other Toxic Effects on Humans	Acute Potential Health Effects Skin: May cause skin irritation. Dermal exposure to zinc may produce leg pains, fatigue, anorexia and weight loss. Eyes: Zinc in the forms of Zinc Metal Sheets; Zinc Metal Shot; Zinc Metal Strips; Zinc Foil; Zinc Metal sticks; Zinc Metal, mossy are not expected to get into the eyes and cause eye irritation. Ingestion: May be harmful if swallowed. May cause digestive tract irritation with tightness in throat, nausea, vomiting, diarrhea, loss of appetite, malaise, abdominal pain, fever, and chills. May affect behavior/central nervous system and autonomic nervous system with ataxia, lethargy, staggering gait, mild derangement in cerebellar function, lightheadness, dizziness, irritability, muscular stiffness, and pain. May also affect blood. Inhalation: Not an inhalation hazard in forms of Zinc Metal Sheets; Zinc Metal Shot; Zinc Metal Strips; Zinc Foil; Zinc Metal sticks; Zinc Metal, mossy when handled under normal conditions. Inhalation of zinc dust or fumes (if metal is smelted) may cause respiratory tract and mucous membrane irritation with cough and chest pain. It can also cause "metal fume fever", a flu-like condition characterized appearance of chills, headachd fever, malaise, fatigue, sweating, extreme thirst, aches in the legs and chest, and difficulty in breathing. A sweet taste may also be present in metal fume fever, as well as a dry throat, aches, nausea, and vomiting, and pale grey cyanosis. The toxicological properties of this substance have not been fully investigated.

**Section 12. Ecological Information**

Ecotoxicity	Not available.
BOD5 and COD	Not available.
Products of Biodegradation	Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.
Toxicity of the Products of Biodegradation	Not available.
Special Remarks on the Products of Biodegradation	Not available.

**Section 13. Disposal Considerations**

Waste Disposal	Waste must be disposed of in accordance with federal, state and local environmental control regulations.
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**Section 14. Transport Information**

DOT Classification	Not a DOT controlled material (United States).
Identification	Not applicable.
Special Provisions for Transport	Not applicable.
DOT (Pictograms)	

**Section 15. Other Regulatory Information and Pictograms**

Federal and State Regulations	New York release reporting list: Zinc Metal Rhode Island RTK hazardous substances: Zinc Metal Pennsylvania RTK: Zinc Metal Florida: Zinc Metal Michigan critical material: Zinc Metal Massachusetts RTK: Zinc Metal New Jersey: Zinc Metal California Director's List of Hazardous Substances: Zinc Metal TSCA 8(b) inventory: Zinc Metal TSCA 12(b) one time export: Zinc Metal SARA 313 toxic chemical notification and release reporting: Zinc Metal CERCLA: Hazardous substances: Zinc Metal: 1000 lbs. (453.6 kg)
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California Proposition 65 Warnings	California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: No products were found. California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: No products were found.
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Other Regulations	EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances (EINECS No. 231-175-3). Canada: Listed on Canadian Domestic Substance List (DSL). China: Listed on National Inventory. Japan: Not listed on National Inventory (ENCS). Korea: Listed on National Inventory (KECI). Philippines: Listed on National Inventory (PICCS). Australia: Listed on AICS.
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Other Classifications	WHMIS (Canada) Not Available
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Continued on Next Page

DSCL (EEC)

R15- Contact with water liberates  
extremely flammable gases  
R17- Spontaneously flammable in air.

S7/8- Keep container tightly closed and dry.

HMIS (U.S.A.)

Health Hazard	(1)
Fire Hazard	(0)
Reactivity	(1)
Personal Protection	(B)

National Fire Protection  
Association (U.S.A.)

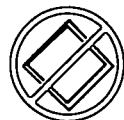
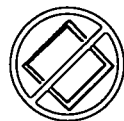
Health



Flammability

Reactivity

Specific hazard

WHMIS (Canada)  
(Pictograms)DSCL (Europe)  
(Pictograms)TDG (Canada)  
(Pictograms)ADR (Europe)  
(Pictograms)

Protective Equipment



Gloves



Lab coat.



Not applicable.  
Safety glasses

**Section 16. Other Information**

MSDS Code Z5025

References Not available.

Other Special Considerations Not available.

Validated by Sonia Owen on 6/25/2009.

Verified by Sonia Owen.  
Printed 6/25/2009.

CALL (310) 516-8000

**Notice to Reader**

*All chemicals may pose unknown hazards and should be used with caution. This Material Safety Data Sheet (MSDS) applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this MSDS. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this MSDS is based on technical data judged to be reliable, Spectrum Quality Products, Inc. assumes no responsibility for the completeness or accuracy of the information contained herein.*

# APPENDIX C

## JOB SAFETY ANALYSIS (JSA)

### DOCUMENTS

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To be provided with Remedial Investigation/Work Plan or as required by Site activities.

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# APPENDIX F

## HASP - JOB SAFETY ANALYSIS FORMS

### SAN JACINTO RIVER WASTE PITS

### SUPERFUND SITE

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**Prepared for**

U.S. Environmental Protection Agency – Region 6

**On behalf of:**

McGinnes Industrial Maintenance Corporation

and

International Paper Company

**Prepared by**

Anchor QEA, LLC

614 Magnolia Avenue

Ocean Springs, Mississippi 39564

**September 2010**



### Field Activities

<b>Project Name:</b> San Jacinto River Waste Pits	<b>Project Number:</b> 090557-01	<b>JSA Number:</b> 001	<b>Issue Date:</b> June 21, 2010
<b>Location:</b> San Jacinto River, Harris County, Texas	<b>Contractor:</b> Anchor QEA	<b>Analysis by:</b> Randy Brown	<b>Analysis Date:</b> June 10, 2010
<b>Work Operation:</b> Field Activities	<b>Superintendent/Competent Person:</b> Jason Kase	<b>Revised by:</b> Chris Torell	<b>Revised Date:</b> June 16, 2010
<b>Required Personal Protective Equipment (PPE):</b> <ul style="list-style-type: none"> <li>Modified Level D - Long pants, long sleeves if handling potentially contaminated media, and steel-toed boots.</li> <li>Depending on activity, the following PPE may also be required: safety glasses/splash goggles, hard hat, nitrile outer gloves and latex inner gloves, Tyvek coveralls, and U.S. Coast Guard-approved personal flotation device (PFD).</li> <li>Heat stress hazards will be considered when selecting PPE.</li> </ul>		<b>Reviewed by:</b> Chris Torell	<b>Reviewed Date:</b> June 16, 2010
		<b>Approved by:</b> Chris Torell	<b>Approved Date:</b> June 22, 2010

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Outdoor, Physical Activity	Slips, Trips, Falls	<ul style="list-style-type: none"> <li>Be aware of potentially slippery or uneven surfaces and tripping hazards.</li> <li>Wear footwear that has sufficient traction to reduce risk of slipping.</li> <li>Wear steel-toed rubber boots versus over-the-shoe rubber boots.</li> <li>Work slowly during transit. Jumping, running, and horseplay are prohibited.</li> <li>Keep all areas clean and free of debris to deter any unnecessary trips and falls.</li> <li>Clean up all spills immediately.</li> <li>Notify the SSO of any unsafe conditions.</li> </ul>	<ul style="list-style-type: none"> <li>Routinely inspect work area for hazards.</li> </ul>

### Field Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Heat Stress (see HASP Section 12.2)	<ul style="list-style-type: none"> <li>Adjust work schedules, as necessary.</li> <li>Perform work during cooler hours of the day if possible or at night if possible and if adequate lighting can be provided.</li> <li>Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.</li> <li>Keep plenty of fluids onsite and stay hydrated.</li> <li>Train workers to recognize the symptoms of heat related illness.</li> </ul>	<ul style="list-style-type: none"> <li>Monitor workers' physical conditions.</li> <li>Monitor outside temperature versus worker activity.</li> </ul>
	Sunshine	<ul style="list-style-type: none"> <li>Have sunscreen available for ultraviolet protection.</li> <li>Have adequate drinking water available to prevent dehydration.</li> <li>Have tinted safety glasses available.</li> </ul>	<ul style="list-style-type: none"> <li>Routinely inspect for sunburn.</li> </ul>
	Rain	<ul style="list-style-type: none"> <li>Have appropriate rain gear available.</li> <li>Be aware of slip hazards, puddles, and electrical hazards when working near water.</li> </ul>	<ul style="list-style-type: none"> <li>Inspect PPE daily prior to potential use.</li> </ul>
	Lightning	<ul style="list-style-type: none"> <li>Have adequate shelter available during a thunderstorm.</li> <li>Do not conduct work on or over water during a thunderstorm; immediately head for shore if on the water and lightning is observed.</li> <li>Do not begin or continue work until lightning subsides for 20 minutes.</li> <li>If unable to get to shore, disconnect and do not use or touch major electronic equipment, including the radio, throughout the duration of the storm.</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>

### Field Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	High Winds/Dust Storm	<ul style="list-style-type: none"> <li>Wear goggles if dust/debris is visible.</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>
	Pollen	<ul style="list-style-type: none"> <li>Take medication (e.g. anti-histamine) to minimize allergic reaction to pollen. If necessary, wear a dust mask.</li> </ul>	<ul style="list-style-type: none"> <li>Inspect PPE daily prior to potential use.</li> </ul>
	Biological Hazards (flora [poison ivy, poison oak, etc.] and fauna [ticks, bees, mosquitoes, snakes, etc.])	<ul style="list-style-type: none"> <li>Personnel will be aware of potential exposure to biological hazards.</li> <li>Wear appropriate clothing (hat, long-sleeve shirt, long pants, leather gloves, boots, Tyvek coveralls, as appropriate) and insect repellent.</li> <li>Personnel will wear thick gloves when clearing plants or debris from work area.</li> </ul>	<ul style="list-style-type: none"> <li>Routinely inspect work area, particularly upon first entering.</li> </ul>
	Noise	<ul style="list-style-type: none"> <li>Maintain adequate distance from heavy equipment.</li> <li>Wear ear plugs or ear muffs, if appropriate, based on noise levels.</li> </ul>	<ul style="list-style-type: none"> <li>Inspect PPE daily prior to use.</li> </ul>
	River/Drowning	<ul style="list-style-type: none"> <li>Observe water depth and speed of current before beginning work.</li> <li>Wear U.S. Coast Guard approved personal flotation device (PFD) as appropriate.</li> </ul>	<ul style="list-style-type: none"> <li>Inspect PPE daily prior to use.</li> </ul>

### Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to initial 40-hour, 8 hour Supervisor and annual 8-hour refresher training.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120 (f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their Supervisor during their Daily Safety Meeting.



## Construction Observation Activities

<b>Project Name:</b> San Jacinto River Waste Pits	<b>Project Number:</b> 090557-01	<b>JSA Number:</b> 002	<b>Issue Date:</b> June 21, 2010
<b>Location:</b> San Jacinto River, Harris County, Texas	<b>Contractor:</b> Anchor QEA	<b>Analysis by:</b> Randy Brown	<b>Analysis Date:</b> June 10, 2010
<b>Work Operation:</b> Construction Observation Activities	<b>Superintendent/Competent Person:</b> Jason Kase	<b>Revised by:</b> Chris Torell	<b>Revised Date:</b> June 16, 2010
<b>Required Personal Protective Equipment (PPE):</b> <ul style="list-style-type: none"><li>Modified Level D – Long pants, long sleeves if handling potentially contaminated media, hard hat, safety glasses, and steel toed boots.</li><li>Depending on activity, the following may also be required: hearing protection, U.S. Coast Guard-approved personal flotation device (PFD), Tyvek coveralls, and nitrile outer gloves and latex inner gloves. Heat stress hazards will be considered when selecting PPE.</li></ul>		<b>Reviewed by:</b> Chris Torell	<b>Reviewed Date:</b> June 16, 2010
		<b>Approved by:</b> Chris Torell	<b>Approved Date:</b> June 22, 2010

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Construction Observation Activities - Materials and Equipment	Slips, Trips, Falls	<ul style="list-style-type: none"><li>Be aware of potentially slippery or uneven surfaces and tripping hazards.</li><li>Wear footwear that has sufficient traction to reduce risk of slipping. Wear steel-toed rubber boots versus over-the-shoe rubber boots.</li><li>Work slowly during transit. Jumping, running, and horseplay are prohibited.</li><li>Keep all areas clean and free of debris to deter any unnecessary trips and falls.</li><li>Do not walk with head down; stand in place when making notes or talking on cell phone.</li><li>Clean up all spills immediately.</li><li>Notify the SSO immediately of any unsafe conditions.</li></ul>	<ul style="list-style-type: none"><li></li></ul>

### Construction Observation Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Traffic/Heavy Equipment Hazards	<ul style="list-style-type: none"> <li>• Maintain a safe distance during loading/unloading operations.</li> <li>• Establish eye contact with equipment operator before moving into their area of operation.</li> <li>• Use spotters to assist trucks and equipment attempting to position themselves in areas with spatial constraints.</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>
	Exposure to Contaminated Materials	<ul style="list-style-type: none"> <li>• Avoid contact with contaminated materials.</li> <li>• Use proper PPE (e.g. gloves) if coming into contact with contaminated materials.</li> <li>• Stay upwind of equipment handling contaminated materials whenever possible.</li> <li>• Properly decontaminate equipment that comes into contact with contaminated materials (consult JSA 008).</li> </ul>	<ul style="list-style-type: none"> <li>• Inspect PPE daily prior to use.</li> </ul>
Outdoor, physical activity	Various	<ul style="list-style-type: none"> <li>• Consult JSA 001 for general field activities.</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>

### Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to initial 40-hour, 8 hour Supervisor and annual 8-hour refresher training.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120 (f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their Supervisor during their Daily Safety Meeting.

**Motor Vehicle Operation**

<b>Project Name:</b> San Jacinto River Waste Pits	<b>Project Number:</b> 090557-01	<b>JSA Number:</b> 003	<b>Issue Date:</b> June 21, 2010
<b>Location:</b> San Jacinto River, Harris County, Texas	<b>Contractor:</b> Anchor QEA	<b>Analysis by:</b> Randy Brown	<b>Analysis Date:</b> June 10, 2010
<b>Work Operation:</b> Motor Vehicle Operation	<b>Superintendent/Competent Person:</b> Jason Kase	<b>Revised by:</b> Chris Torell	<b>Revised Date:</b> June 16, 2010
<b>Required Personal Protective Equipment (PPE):</b> <ul style="list-style-type: none"><li>• Seat belt</li></ul>		<b>Reviewed by:</b> Chris Torell	<b>Reviewed Date:</b> June 16, 2010
		<b>Approved by:</b> Chris Torell	<b>Approved Date:</b> June 22, 2010

<b>Work Activity</b>	<b>Potential Hazards</b>	<b>Preventive or Corrective Measures</b>	<b>Inspection Requirements</b>
Driving to, from, and within the project Site	Vehicular Accident	<ul style="list-style-type: none"><li>• Plan your travel route and check maps for directions or discuss with colleagues.</li><li>• Clean windows and mirrors, as needed throughout the trip.</li><li>• Wear seat belt.</li><li>• Wear sun glasses, as needed.</li><li>• Follow vehicle maintenance schedule to reduce possibilities of breakdown while driving.</li><li>• Avoid distractions while driving.</li></ul>	<ul style="list-style-type: none"><li>• Inspect fluid levels, air pressure in tires, adjust mirrors and seat position appropriately, and maintain adequate fuel level.</li><li>• Check around vehicle for obstructions before starting.</li></ul>
	Distraction While Driving	<ul style="list-style-type: none"><li>• Stop driving vehicle, regardless of speed (i.e., even 5 mph or less) or location (i.e., even if private road), when the potential for being distracted by conversation exists.</li><li>• Drivers are prohibited from using hand-held communication devices (e.g., cell phones) while operating any motor vehicle.</li></ul>	<ul style="list-style-type: none"><li>•</li></ul>

### Motor Vehicle Operation

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Fatigue	<ul style="list-style-type: none"> <li>• Get adequate rest prior to driving.</li> <li>• Maintain alertness by changing seat position regularly, stretching, opening a window, adjusting the radio volume, or other techniques as appropriate.</li> <li>• If experiencing drowsiness, pull over at a safe location and rest.</li> </ul>	•
	Inclement Weather/Road Conditions	<ul style="list-style-type: none"> <li>• Check weather and road conditions prior to driving.</li> <li>• If conditions change, be prepared to adjust driving.</li> <li>• Allow extra distance between your vehicle and the vehicle ahead.</li> <li>• Travel in daylight hours, if possible.</li> <li>• Use lights at night and lights/wipers during inclement weather.</li> </ul>	•
	Heavy Traffic	<ul style="list-style-type: none"> <li>• If available, listen to traffic reports prior to driving. Adjust planned travel route if necessary.</li> <li>• Maintain adequate following distance to allow time for slow downs, due to construction, accidents, or other unforeseen circumstances.</li> <li>• Take alternate route to avoid congested areas if necessary.</li> </ul>	•

**Motor Vehicle Operation****Training Requirements:**

- All drivers are required to have a valid driver's license.
- All vehicles registered in Texas must have vehicle registration and inspection stickers.
- Use of hand-held wireless devices is prohibited while driving any vehicle for any use at any time, and as defined by law.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their Supervisor during their Daily Safety Meeting.



**Boat/Barge Activities**

<b>Project Name:</b> San Jacinto River Waste Pits	<b>Project Number:</b> 090557-01	<b>JSA Number:</b> 004	<b>Issue Date:</b> June 21, 2010
<b>Location:</b> San Jacinto River, Harris County, Texas	<b>Contractor:</b> Anchor QEA	<b>Analysis by:</b> Randy Brown	<b>Analysis Date:</b> June 10, 2010
<b>Work Operation:</b> Boat/Barge Activities	<b>Superintendent/Competent Person:</b> Jason Kase	<b>Revised by:</b> Chris Torell	<b>Revised Date:</b> June 16, 2010
<b>Required Personal Protective Equipment (PPE):</b> <ul style="list-style-type: none"><li>Modified Level D – safety glasses, steel toed boots, long pants.</li><li>U.S. Coast Guard-approved personal flotation device (PFD).</li><li>Depending on activity, the following may also be required: hard hat nitrile outer gloves and latex inner gloves, Tyvek coveralls.</li></ul>		<b>Reviewed by:</b> Chris Torell	<b>Reviewed Date:</b> June 16, 2010
		<b>Approved by:</b> Chris Torell	<b>Approved Date:</b> June 22, 2010

<b>Work Activity</b>	<b>Potential Hazards</b>	<b>Preventive or Corrective Measures</b>	<b>Inspection Requirements</b>
Boat/Barge Activities	Marine Operation Hazards	<ul style="list-style-type: none"><li>Equip all water vessels in accordance with U.S. Coast Guard regulations.</li></ul>	<ul style="list-style-type: none"><li>Perform daily review of the Boating Checklist.</li></ul>
Navigation	Boat Traffic	<ul style="list-style-type: none"><li>Maintain a safe operating distance from shoreline, other vessels, etc.</li></ul>	<ul style="list-style-type: none"><li></li></ul>
	Waves, Surges, Currents	<ul style="list-style-type: none"><li>Be aware of sudden surges caused by incoming waves, unstable waters, and currents.</li></ul>	<ul style="list-style-type: none"><li></li></ul>
	Capsize Boat	<ul style="list-style-type: none"><li>Keep weight in boat evenly distributed.</li><li>Be conscious of shallow water conditions in and near project site and operate boat with care in shallow-water areas.</li><li>Keep boat speed at reasonable level.</li><li>Avoid areas with heavy debris or vegetation.</li><li>Allow only experienced operators to dock and launch boats.</li></ul>	<ul style="list-style-type: none"><li></li></ul>

### Boat/Barge Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Fire or Major Emergency – Abandon Ship	<ul style="list-style-type: none"> <li>• Be prepared to abandon ship in the event of fire that is too large to control with fire extinguisher or other major emergency.</li> <li>• Only the boat captain can order abandon ship.</li> <li>• Communicate intent to abandon ship to all personnel on board.</li> <li>• Call 911.</li> <li>• Notify nearby vessels of intent to abandon ship.</li> <li>• Notify Project Manager and CHSO, if time permits.</li> <li>• Be aware of position of the propeller before abandoning ship.</li> <li>• Identify a rally point for all personnel.</li> <li>• Use the buddy system to support injured personnel.</li> </ul>	<ul style="list-style-type: none"> <li>• Abandon Ship drill should be done on an annual basis.</li> </ul>

### Boat/Barge Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Loading/unloading equipment onto vessel	General	<ul style="list-style-type: none"> <li>Secure boat.</li> <li>Use rails or have someone on the dock assist.</li> <li>Be cautious when entering or exiting the vessel. With one hand on the boat, quickly lower straight down into the center of the craft. Never jump into or off of a vessel.</li> <li>If others are boarding, have them step along the fore-and aft centerline of the boat while the boat is held in place along the pier.</li> <li>Avoid directly carrying anything on or off the vessel. Load the items off the pier or have someone hand them to you one by one.</li> <li>Never overload the vessel.</li> <li>Keep weight toward center of the boat and center of gravity as low as possible.</li> <li>Distribute equipment evenly on vessel.</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>
Sampling Activities	Slips, Trips, Falls	<ul style="list-style-type: none"> <li>Be aware of potentially slippery surfaces and tripping hazards.</li> <li>Wear footwear that has sufficient traction to reduce risk of slipping.</li> <li>Wear steel-toed rubber boots versus over-the-shoe rubber boots.</li> <li>Work slowly during transit. Jumping, running, and horseplay are prohibited.</li> <li>Proceed carefully on floating docks and ramps.</li> <li>Keep all areas clean and free of debris to deter any unnecessary trips and falls.</li> <li>Clean up all spills immediately.</li> <li>Notify the SSO immediately of any unsafe conditions.</li> </ul>	<ul style="list-style-type: none"> <li>Routinely inspect work area for hazards.</li> </ul>

### Boat/Barge Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Falls Off Boat/Drowning Hazards	<ul style="list-style-type: none"> <li>Wear footwear that has sufficient traction to reduce risk of slipping.</li> <li>Wear personal flotation device.</li> <li>Be aware of any obstacles on boat deck.</li> </ul>	<ul style="list-style-type: none"> <li>Inspect PFDs daily prior to use.</li> </ul>
	Man Overboard	<ul style="list-style-type: none"> <li>Yell "man overboard".</li> <li>If the engine is running, take it out of gear and swing the stern clear to keep from hitting the person.</li> <li>Call 911, as appropriate.</li> <li>Assign a spotter to keep the person in sight at all times.</li> <li>Contact nearby vessels for assistance.</li> <li>Throw flotation devices immediately.</li> <li>Recover person from water.</li> <li>If you fall overboard, hold your mouth and nose closed and protect your head.</li> <li>When you reach the surface, look for movement, listen for sounds and call for help. If available, use the whistle attached to the PFD, and activate the beacon light.</li> <li>It is only sensible to swim if there is reason to believe that a chance of reaching your destination exists.</li> <li>Wear personal flotation device.</li> </ul>	<ul style="list-style-type: none"> <li>Man Overboard drill should be done on an annual basis.</li> </ul>
	Muscle strain/injury from improper lifting	<ul style="list-style-type: none"> <li>Utilize proper lifting techniques or ask for assistance with moving/lifting objects.</li> <li>Load and unload items from the boat one by one. Have someone hand them to you.</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>

### Boat/Barge Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Heat Stress (see HASP Section 12.2)	<ul style="list-style-type: none"> <li>Adjust work schedules, as necessary.</li> <li>Perform work during cooler hours of the day if possible or at night if possible and if adequate lighting can be provided.</li> <li>Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.</li> <li>Keep plenty of fluids onsite; stay hydrated.</li> <li>Train workers to recognize the symptoms of heat related illness.</li> </ul>	<ul style="list-style-type: none"> <li>Monitor workers physical conditions.</li> <li>Monitor outside temperature versus worker activity.</li> </ul>
	Rain	<ul style="list-style-type: none"> <li>Have appropriate rain gear available.</li> <li>Be aware of slip hazards, puddles, and electrical hazards when working near water.</li> </ul>	<ul style="list-style-type: none"> <li>Inspect PPE daily prior to use.</li> </ul>
	Sunshine	<ul style="list-style-type: none"> <li>Have sunscreen available for ultraviolet protection.</li> <li>Have adequate drinking water available to prevent dehydration.</li> <li>Have tinted safety glasses available.</li> </ul>	<ul style="list-style-type: none"> <li>Routinely inspect for sunburn.</li> </ul>
	Fog	<ul style="list-style-type: none"> <li>Wait for fog to lift and there is adequate visibility before operating sampling vessel.</li> </ul>	<ul style="list-style-type: none"> <li>Inspect boat lights.</li> </ul>

### Boat/Barge Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Lightning	<ul style="list-style-type: none"> <li>• Have adequate shelter available during a thunderstorm.</li> <li>• Do not conduct work on or over water during a thunderstorm; immediately head for shore if on the water and lightning is observed.</li> <li>• Do not begin or continue work until lightning subsides for 20 minutes.</li> <li>• If unable to get to shore, disconnect and do not use or touch major electronic equipment, including the radio, throughout the duration of the storm.</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>

### Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to initial 40-hour, 8 hour Supervisor and annual 8-hour refresher training. All boat operators must have successfully completed a safe boating course.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120 (f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their Supervisor during their Daily Safety Meeting.



## Daily Boat Checklist

Date: \_\_\_\_\_ Completed by: \_\_\_\_\_

Boat ID: \_\_\_\_\_

Item	Yes	No	N/A	Comments
Vessel Registration Numbers Displayed				
Vessel Registration Documentation on Board				
PFDs – One Available Per Person				
PFDs – Condition/Inspection				
First Aid Kit				
Eye Wash Solution				
Fire Extinguisher				
Visual Distress Signal				
Sound Producing Device				
Navigation Lights				
Paddle				
Rescue Ring				
Project Health and Safety Plan				
Cellular phone				
Spill Kit				
PPE (Hard hats, safety glasses, steel toe boots, etc.)				
Cold Weather Suit				
GFI				
Radio Check				
Clear Deck, Work Area				

Comments: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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\_\_\_\_\_

**Boat/Barge Fueling**

<b>Project Name:</b> San Jacinto River Waste Pits	<b>Project Number:</b> 090557-01	<b>JSA Number:</b> 005	<b>Issue Date:</b> June 21, 2010
<b>Location:</b> San Jacinto River, Harris County, Texas	<b>Contractor:</b> Anchor QEA	<b>Analysis by:</b> Randy Brown	<b>Analysis Date:</b> June 10, 2010
<b>Work Operation:</b> Boat/Barge Fueling	<b>Superintendent/Competent Person:</b> Jason Kase	<b>Revised by:</b> Chris Torell	<b>Revised Date:</b> June 16, 2010
<b>Required Personal Protective Equipment (PPE):</b> <ul style="list-style-type: none"><li>• Modified Level D – safety glasses/splash goggles, steel toed boots, long pants, nitrile outer gloves and latex inner gloves.</li><li>• U.S. Coast Guard approved-personal flotation device (PFD).</li><li>• Depending on the activity, may also require hard hat and Tyvek coveralls.</li><li>• Heat stress hazards will be considered when selecting PPE.</li></ul>		<b>Reviewed by:</b> Chris Torell	<b>Reviewed Date:</b> June 16, 2010
		<b>Approved by:</b> Chris Torell	<b>Approved Date:</b> June 22, 2010

<b>Work Activity</b>	<b>Potential Hazards</b>	<b>Preventive or Corrective Measures</b>	<b>Inspection Requirements</b>
Boat/Barge Activities	Marine Operation Hazards	<ul style="list-style-type: none"><li>• Equip all water vessels in accordance with U.S. Coast Guard regulations.</li></ul>	<ul style="list-style-type: none"><li>• Perform daily review of the Boating Checklist.</li></ul>
Navigation	Boat Traffic, Waves, Surges, or Currents, Capsize Boat	<ul style="list-style-type: none"><li>• Do not operate boat during fueling operations.</li><li>• Turn off motor and equipment in boat.</li></ul>	<ul style="list-style-type: none"><li>• </li></ul>
Boat/Barge Fueling	Overflow/spills of fuel in or onto boat or water	<ul style="list-style-type: none"><li>• Ensure that fuel pumps have a UL-listed automatic closing valve.</li><li>• Use approved safety containers.</li><li>• Be aware of the capacity of fuel tank/container.</li><li>• Have spill kit available.</li></ul>	<ul style="list-style-type: none"><li>• Follow operations manual maintenance and inspection procedures for each piece of equipment used on site.</li></ul>



**Boat/Barge Fueling**

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Explosion	<ul style="list-style-type: none"><li>• Use approved safety containers to store and transport fuel.</li><li>• No smoking on site or open flame within 50 feet.</li><li>• Shut down equipment/motors that use flammable fuel during fueling, servicing, or maintenance activities.</li></ul>	<ul style="list-style-type: none"><li>•</li></ul>
	Spill on clothing	<ul style="list-style-type: none"><li>• Be aware of capacity of fuel tank and do not overfill.</li><li>• Wear appropriate PPE while fueling.</li><li>• Change clothing if saturated with fuel.</li></ul>	<ul style="list-style-type: none"><li>• Inspect PPE daily.</li></ul>

**Training Requirements:**

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to initial 40-hour, 8 hour Supervisor and annual 8-hour refresher training. All boat operators must have successfully completed a safe boating course.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120 (f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their Supervisor during their Daily Safety Meeting.

### Water Sampling

<b>Project Name:</b> San Jacinto River Waste Pits	<b>Project Number:</b> 090557-01	<b>JSA Number:</b> 006	<b>Issue Date:</b> June 21, 2010
<b>Location:</b> San Jacinto River, Harris County, Texas	<b>Contractor:</b> Anchor QEA	<b>Analysis by:</b> Randy Brown	<b>Analysis Date:</b> June 10, 2010
<b>Work Operation:</b> Water Sampling	<b>Superintendent/Competent Person:</b> Jason Kase	<b>Revised by:</b> Chris Torell	<b>Revised Date:</b> June 16, 2010
<b>Required Personal Protective Equipment (PPE):</b> <ul style="list-style-type: none"> <li>Modified Level D – safety glasses/splash goggles, steel toed boots, long pants, nitrile outer gloves and latex inner gloves, long sleeves if handling potentially contaminated media.</li> <li>U.S. Coast Guard-approved personal flotation device (PFD).</li> <li>Depending on activity, the following may also be required: hard hat, Tyvek coveralls, and hearing protection.</li> </ul>		<b>Reviewed by:</b> Chris Torell	<b>Reviewed Date:</b> June 16, 2010
		<b>Approved by:</b> Chris Torell	<b>Approved Date:</b> June 22, 2010

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Water Sampling	Boating Hazards	<ul style="list-style-type: none"> <li>Follow JSA 004 (Boat/Barge Activities) when working near or on the water.</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>
	Inhalation of contaminants Ingestion of contaminants Skin/eye contact with contaminated materials	<ul style="list-style-type: none"> <li>Wear appropriate PPE.</li> <li>Contact 911, as necessary.</li> <li>If a person breathes in a large amount of organic vapor, move the exposed person to fresh air, rinse mouth. Perform CPR if breathing stops.</li> <li>If exposure to contaminated materials occurs, promptly wash contaminated skin using soap or mild detergent and water. Rinse eyes with large amounts of water.</li> <li>Keep the affected person warm and at rest.</li> </ul>	<ul style="list-style-type: none"> <li>Inspect PPE daily prior to use.</li> </ul>

### Water Sampling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Sampling Activities	Slips, Trips, Falls	<ul style="list-style-type: none"> <li>• Be aware of potentially slippery surfaces and tripping hazards.</li> <li>• Wear footwear that has sufficient traction to reduce risk of slipping.</li> <li>• Wear steel-toed rubber boots versus over-the-shoe rubber boots.</li> <li>• Work slowly during transit. Jumping, running, and horseplay are prohibited.</li> <li>• Proceed carefully on floating docks and ramps.</li> <li>• Keep all areas clean and free of debris to deter any unnecessary trips and falls.</li> <li>• Clean up all spills immediately.</li> <li>• Notify the SSO of any unsafe conditions.</li> </ul>	<ul style="list-style-type: none"> <li>• Routinely inspect work area for hazards.</li> </ul>
	Dermal Exposure	<ul style="list-style-type: none"> <li>• Wear appropriate PPE during sampling activities, including but not limited to protective gloves and safety glasses.</li> </ul>	<ul style="list-style-type: none"> <li>• Inspect PPE daily prior to use.</li> </ul>
	Noise Exposure	<ul style="list-style-type: none"> <li>• Wear hearing protection in high noise areas or when working around heavy machinery or equipment (action level of 85 decibels [dBA] averaged over an eight-hour day).</li> </ul>	<ul style="list-style-type: none"> <li>• Inspect PPE daily prior to use.</li> </ul>
	Struck By / Pinch Points	<ul style="list-style-type: none"> <li>• Maintain awareness of procedures underway and be attentive of sampling operations.</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>

### Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to initial 40-hour, 8 hour Supervisor and annual 8-hour refresher training. All boat operators

**Water Sampling**

must have successfully completed a safe boating course.

- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120 (f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their Supervisor during their Daily Safety Meeting.

### Personal Decontamination

<b>Project Name:</b> San Jacinto River Waste Pits	<b>Project Number:</b> 090557-01	<b>JSA Number:</b> 007	<b>Issue Date:</b> June 21, 2010
<b>Location:</b> San Jacinto River, Harris County, Texas	<b>Contractor:</b> Anchor QEA	<b>Analysis by:</b> Randy Brown	<b>Analysis Date:</b> June 10, 2010
<b>Work Operation:</b> Personal Decontamination	<b>Superintendent/Competent Person:</b> Jason Kase	<b>Revised by:</b> Chris Torell	<b>Revised Date:</b> June 16, 2010
<b>Required Personal Protective Equipment (PPE):</b> <ul style="list-style-type: none"> <li>Modified Level D – safety glasses/splash goggles, steel toed boots, and long pants.</li> <li>Depending on activity, the following may also be required: hard hat, nitrile outer gloves and latex inner gloves, long sleeves Tyvek coveralls, hearing protection, and U.S. Coast Guard-approved personal flotation device (PFD).</li> <li>Heat stress hazards will be considered when selecting PPE.</li> </ul>		<b>Reviewed by:</b> Chris Torell	<b>Reviewed Date:</b> June 16, 2010
		<b>Approved by:</b> Chris Torell	<b>Approved Date:</b> June 22, 2010

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Decontaminate Personnel Exiting the Exclusion Zone	General	<ul style="list-style-type: none"> <li>Use appropriate PPE to reduce exposure.</li> <li>Follow decontamination procedures as described in the site-specific Health and Safety Plan (HASP).</li> <li>Collect rinse water and used PPE and dispose per appropriate standard operating procedures described in the HASP.</li> </ul>	<ul style="list-style-type: none"> <li>Inspect PPE daily prior to use.</li> </ul>
	Site Hazardous Material Exposure	<ul style="list-style-type: none"> <li>Training and safety awareness of potential exposure to chemicals of concern at the site and decontamination procedure. Review chemicals of concern.</li> <li>Wear appropriate PPE (e.g. Tyvek, nitrile gloves, safety glass, etc.).</li> </ul>	<ul style="list-style-type: none"> <li>Inspect PPE daily prior to use.</li> </ul>

### Personal Decontamination

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Slips, Trips, Falls	<ul style="list-style-type: none"> <li>• Be aware of potentially slippery surfaces and tripping hazards.</li> <li>• Wear footwear that has sufficient traction to reduce risk of slipping.</li> <li>• Wear steel-toed rubber boots versus over-the-shoe rubber boots.</li> <li>• Work slowly during transit. Jumping, running, and horseplay are prohibited.</li> <li>• Proceed carefully on floating docks and ramps.</li> <li>• Keep all areas clean and free of debris to deter any unnecessary trips and falls.</li> <li>• Clean up all spills immediately.</li> <li>• Notify the SSO of any unsafe conditions.</li> </ul>	<ul style="list-style-type: none"> <li>• Routinely inspect work areas for hazards.</li> </ul>
	Heat Stress (see HASP Section 12.2)	<ul style="list-style-type: none"> <li>• Adjust work schedules, as necessary.</li> <li>• Perform work during cooler hours of the day if possible or at night if possible and if adequate lighting can be provided.</li> <li>• Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.</li> <li>• Maintain body fluids at normal levels.</li> <li>• Train workers to recognize the symptoms of heat related illness.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitor workers' physical conditions.</li> <li>• Monitor outside temperature versus worker activity.</li> </ul>

### Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to initial 40-hour, 8 hour Supervisor and annual 8-hour refresher training. All boat operators must have successfully completed a safe boating course.

**Personal Decontamination**

- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120 (f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their Supervisor during their Daily Safety Meeting.



### Tool and Equipment Decontamination

<b>Project Name:</b> San Jacinto River Waste Pits	<b>Project Number:</b> 090557-01	<b>JSA Number:</b> 008	<b>Issue Date:</b> June 21, 2010
<b>Location:</b> San Jacinto River, Harris County, Texas	<b>Contractor:</b> Anchor QEA	<b>Analysis by:</b> Randy Brown	<b>Analysis Date:</b> June 10, 2010
<b>Work Operation:</b> Tool and Equipment Decontamination	<b>Superintendent/Competent Person:</b> Jason Kase	<b>Revised by:</b> Chris Torell	<b>Revised Date:</b> June 16, 2010
<b>Required Personal Protective Equipment (PPE):</b> <ul style="list-style-type: none"> <li>Modified Level D – safety glasses/splash goggles, steel toed boots, long pants, hard hat, nitrile outer gloves and latex inner gloves, and Tyvek coveralls.</li> <li>Personal flotation device (PFD) if decontamination performed over water.</li> </ul>		<b>Reviewed by:</b> Chris Torell	<b>Reviewed Date:</b> June 16, 2010
		<b>Approved by:</b> Chris Torell	<b>Approved Date:</b> June 22, 2010

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Decontaminate tools and equipment in accordance with site-specific Health and Safety Plan	Site Hazardous Material Exposure	<ul style="list-style-type: none"> <li>Training and safety awareness of potential exposure to chemicals of concern at the site and decontamination procedure. Review chemicals of concern.</li> <li>Follow appropriate decontamination procedures.</li> <li>Wear appropriate PPE (e.g. Tyvek, nitrile gloves, safety glass, etc.).</li> </ul>	<ul style="list-style-type: none"> <li>Inspect PPE daily prior to use.</li> </ul>
	Heat Stress (see HASP Section 12.2)	<ul style="list-style-type: none"> <li>Adjust work schedules, as necessary.</li> <li>Perform work during cooler hours of the day if possible or at night if possible and if adequate lighting can be provided.</li> <li>Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.</li> <li>Maintain body fluids at normal levels.</li> <li>Train workers to recognize the symptoms of heat related illness.</li> </ul>	<ul style="list-style-type: none"> <li>Monitor workers' physical conditions.</li> <li>Monitor outside temperature versus worker activity.</li> </ul>



### Tool and Equipment Decontamination

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Slips, Trips, Falls	<ul style="list-style-type: none"> <li>• Be aware of potentially slippery surfaces and tripping hazards.</li> <li>• Wear footwear that has sufficient traction to reduce risk of slipping.</li> <li>• Wear steel-toed rubber boots versus over-the-shoe rubber boots.</li> <li>• Work slowly during transit. Jumping, running, and horseplay are prohibited.</li> <li>• Proceed carefully on floating docks and ramps.</li> <li>• Keep all areas clean and free of debris to deter any unnecessary trips and falls.</li> <li>• Clean up all spills immediately.</li> <li>• Notify the SSO of any unsafe conditions.</li> </ul>	<ul style="list-style-type: none"> <li>• Routinely inspect work area for hazards.</li> </ul>

### Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to initial 40-hour, 8 hour Supervisor and annual 8-hour refresher training. All boat operators must have successfully completed a safe boating course.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120 (f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their Supervisor during their Daily Safety Meeting.



1423 Third Avenue, Suite 300  
Seattle, Washington 98101  
Phone 206.287.9130  
Fax 206.287.9131  
www.anchorqea.com

## MEMORANDUM

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**To:** Darren Habel, U.S. Army Corps of Engineers; **Date:** September 13, 2010  
William Rehe, WDFW  
Gayle Kreitman, NMFS;  
Jenni Dykstra, USFWS;

**From:** Gisele Sassen, Anchor QEA

**Cc:** David Hanna and Kip Summers, OPARD;  
Ed Berschinski, Bruce McDonald, P.E., and  
Michael Whelan, P.E., Anchor QEA

**Re:** Proposed Design Modification due to Unforeseen Slope Condition  
Percival Landing Major Rehabilitation Project – Section A Construction  
**Corps Reference Number NWS-2009-1194 / NMFS 2009/06412**  
City of Olympia Parks, Arts and Recreation Department

---

This memorandum is written to inform you of an unforeseen slope condition necessitating modification of the design as documented in the original construction drawings and specifications, the mitigation plan and the permits issued, and to propose a remedy for this issue that would be as consistent as possible with permit conditions.

### SLOPE PROTECTION – UNFORSEEN CONDITION

As part of the Section A – Phase I construction the shoreline will be excavated during daytime low tides (in the dry – as much as possible at this time of year) down to elevation - 2 feet MLLW, and protective shoreline materials installed on the excavated slope surface leaving a finished grade that slopes upward from elevation 0 MLLW. An unforeseen condition was encountered while excavating the shoreline north of State Avenue (near the Les Schwab property). Significant groundwater flows were encountered, emerging from behind a buried timber crib wall (see Photo 1). Prior to excavation, no significant groundwater discharge was observed at low tide so it may have been restrained by the buried crib wall.



**Photo 1**  
**Ground Water seeping from excavated bank**



**Photo 2**  
**Well-graded Gravel washed away –  
Quarry Spalls remain in place**

---

The contractor excavated a 40-foot wide area and placed well-graded gravel, per drawings and specifications and permits issued, during the course of a low tide event, but after the area was inundated by higher tides and then re-exposed (completing one tidal cycle), the Well-Graded G was found to have washed off of the slope. We believe the groundwater flow and tidal inundation both contributed to the loss of material. To stabilize the slope, In order to achieve an immediate stable surface for the excavated slope the contractor was then directed to place a layer of quarry spalls in the location of significant groundwater flow, which held up well under these conditions (see Photo 2).

We do not know at this point whether the presence of significant seepage, is a localized condition, whether it is in any way associated with the former crib wall, nor if the crib wall and/or the ground water seepages continue along the entire or portions of the shoreline within the project limits. But we do know that we cannot rely on the well-graded gravel to stay in place if these conditions occur, and we have reason to believe that the material may also be unsuitable to stabilize the slope in the remaining areas of the shoreline.

## **PROPOSED DESIGN MODIFICATION**

In an effort to address this slope stabilization issue we are proposing the following design modifications including changing the cross sections and by modifying the material composition of the well-graded gravel for the areas identified as Part A and Part B (see Figures 1 and 2).

### **Modified Permeable Well-graded Gravel**

After careful review and consideration we are proposing to modify the well-graded gravel material to a more permeable material, by increasing the larger components and by decreasing the amount of fines. This modified mix of materials would be better suited to allowing seepage to pass through lessening the potential for destabilizing, sloughing, or washing away of the slope protection material. Modifications are proposed as follows:

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**Table 1**  
**Material Comparison**

<b>Material/ Sieve Sizes</b>	<b>Percent (by weight) passing, Original Well Graded Gravel</b>	<b>Percent (by weight) passing, Modified Permeable Well-graded Gravel</b>
4 inches	100	100
3 inches		60-90
2-1/2 inches	65	
2 inches		40-70
1 inch	33	
¾-inch		15-40
5/8-inch	28	
No. 4	17	0-5
No. 40	7	
No. 100		0-2
No. 200	1.1	100

### **PART A – Slope Protection Cross Sections**

Depending on the amount of ground water observed in the field after the bank has been excavated to the subgrade, one of two options will be considered for the areas within the portion of the site shown as Part A on the attached sketch (Figures 1 and 2).

If significant amounts of ground water are observed, the placement of a 12-inch layer of Quarry Spalls is proposed, in lieu of the Well-Graded Gravel layer. A surficial 6-inch-thick layer of Habitat Substrate will be placed over this initial layer, as originally

planned. The determination of appropriate material type will be made on the basis of individual sections that are excavated within a given tide cycle. Generally, the contractor works in 40-foot-long sections, but vary depending on the duration and elevation of the low tide. Portions of Part A not observed to be affected by significant seepage will receive the Modified Permeable Well-Graded Gravel (see Table 1).

In cases where we utilize the modified Permeable Well-Graded Gravel, it will be possible for us to increase the coverage of surficial Habitat Substrate (2 ½ inch minus) to nine inches, rather than six inches, so as to increase the volume of habitat substrate. We would also decrease the thickness of well-graded gravel to 9 inches to maintain the same final grades.

### **Part B – Slope Protection Cross Section**

In the area designated as Part B on Figure 1, the first step in the construction process will be to excavate and construct a “test area” in which the original Well-Graded Gravel material will be placed; Presuming that little or no detectable groundwater flow is encountered. If the placement of the well-graded gravel within the test area proves successful and stable, then we anticipate continuing to place this original material (12-inch layer of Well-Graded Gravel overlain with 6 inches of Habitat Substrate), throughout the section of work identified as Part B (see Figure 2), provided that it remains in place successfully throughout the rest of the area.

If instead the test strip indicates that the Well-Graded Gravel is not stable, or if once again significant groundwater seepage is observed, we propose to place 9 inches of Modified Permeable Well-Graded Gravel overlain with 9 inches of Habitat Substrate instead, as is proposed for Part A. By reducing the depth of the base layer in these areas from 12 inches to 9 inches and by increasing the depth of the habitat substrate (2 1/2 inch minus), the volume of the habitat substrate would be significantly increased.

### **PERMIT CONDITIONS**

The original slope protection cross section designed to prevent erosion of the shoreline included placement of a geo-textile fabric, 12 inches of quarry spalls (8 inch minus) and a 6-inch layer of habitat substrate (2 ½ minus) for areas below elevation 0 feet MLLW and

---

placement of 12 inches of Well-Graded Gravel covered with 6 inches of habitat substrate for areas above elevation 0 feet MLLW along the entire shoreline. During permit review, the design was changed based on discussions with the resource agencies to restrict this cross section to the area south of State Avenue at the request of resource agencies. In the areas north of State Avenue, the underlying layer of quarry spalls was replaced with the smaller-grained, Well-Graded Gravel material, as was specified for the base layer above elevation 0 feet MLLW (Figure 3). Unfortunately, we have found that the replacement material is not physically suited to the conditions of seepage and tidal erosion that are present in the portion of the site encountered to date.

We acknowledge that the proposed modification deviates from what was permitted, but we believe that it is the most sensible remedy for the problem at hand given the conditions that have been encountered. It still disallows geotextile fabric and limits quarry spalls to areas that have observed groundwater issues. Even this proposed modification is a significant improvement over the existing heavy rip rap and concrete debris covered slopes.

We are hoping to resolve this issue as soon as possible so that the contractor can take advantage of the few remaining day time low tides to do the shoreline work as city noise ordinance prohibits night time low tide work. We trust that this memorandum sufficiently explains the unforeseen conditions that were encountered, and that the proposed remedy will find your support. Please let us know if you have any questions or concerns at your earliest convenience as we need your understanding and support to achieve immediate resolution to this problem.

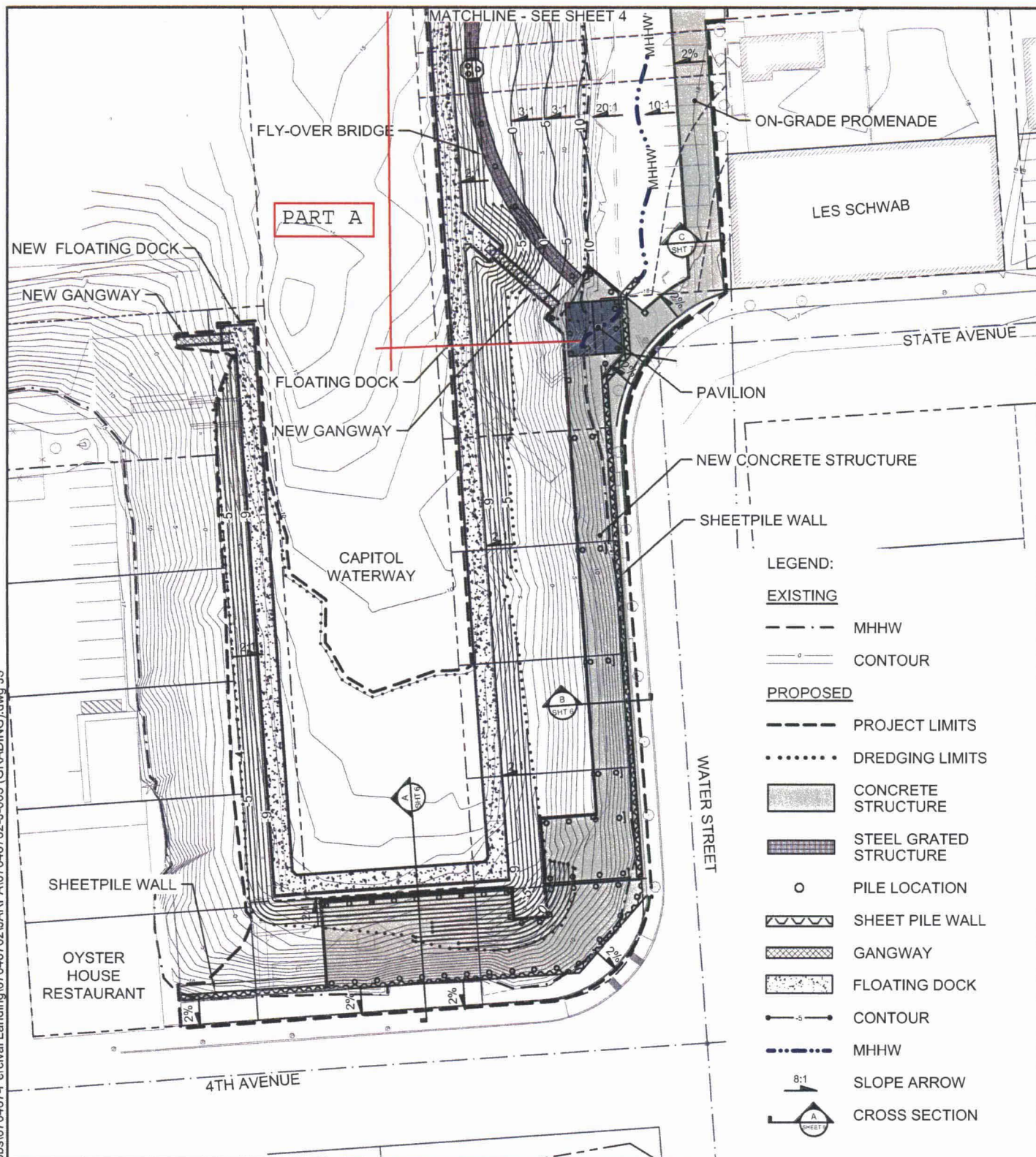
#### **LIST OF ATTACHMENTS**

- |          |                                   |
|----------|-----------------------------------|
| Figure 1 | Part A Site Plan                  |
| Figure 2 | Parts A and B Site Plan           |
| Figure 3 | Previous Slope Protection Details |



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Aug 17, 2009 3:41pm tgriga



HORIZONTAL DATUM: CITY OF OLYMPIA  
VERTICAL DATUM: MEAN LOWER LOW (MLLW)

### PROPOSED SITE PLAN - AREA 1

0 60  
SCALE IN FEET



PURPOSE: PUBLIC WATERFRONT PARK  
IMPROVEMENTS  
DATUM: LAT 47°02'47.2"N  
LONG 122°54'15.3"W  
ADJACENT PROPERTY OWNERS:  
DNR, CITY OF OLYMPIA, T&L LLC, WATER  
ST BUILDING LLC, DAVID & SHERI SHAUB,  
MG BURGHIER & ASSOCIATES

NAME: PERCIVAL LANDING SECTION A  
REFERENCE #:  
SITE LOCATION ADDRESS:  
4TH AVENUE AND WATER STREET NW  
OLYMPIA, WA 98501

PROPOSED: BOARDWALK & FLOATING  
DOCK REPLACEMENT, MAINTENANCE  
DREDGING, AND SHORELINE RESTORATION  
IN: OLYMPIA  
NEAR/AT: WEST BAY  
COUNTY OF: THURSTON  
STATE: WASHINGTON  
DATE: AUGUST 2009  
SHEET: 3 OF 12

FIGURE 1



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Aug 17, 2009 3:41pm tgriga

#### LEGEND:

##### EXISTING

- MHHW
- CONTOUR

##### PROPOSED

- PROJECT LIMITS
- DREDGING LIMITS
- CONCRETE STRUCTURE
- STEEL GRATED STRUCTURE
- RECYCLED WOOD DECKING
- PILE LOCATION
- SHEET PILE WALL
- GANGWAY
- FLOATING DOCK
- CONTOUR
- MHHW
- SLOPE ARROW
- CROSS SECTION

REMOVE AND REPLACE APPROXIMATELY 20' OF 6" PVC STORM DRAIN TO ACCOMMODATE WALL CONSTRUCTION. DAYLIGHT IE=11.60

BUDD INLET

NEW GANGWAY

SHEETPILE WALL

FLY-OVER BRIDGE

NEW FLOATING DOCK

NEW FLOATING STAGE

BRIDGE

PART B

PART A

PAVILION

NEW VIEWING PIER

NEW FINGER PIER

NEW BATHHOUSE

SHEETPILE WALL

PROPOSED INLET

SHEETPILE WALL

ON-GRADE PROMENADE

PAVILION

OLYMPIA AVENUE

IMPROVED PARKING

HORIZONTAL DATUM: CITY OF OLYMPIA  
VERTICAL DATUM: MEAN LOWER LOW (MLLW)

#### PROPOSED SITE PLAN - AREA 2

0 60  
SCALE IN FEET



PURPOSE: PUBLIC WATERFRONT PARK IMPROVEMENTS

DATUM: LAT 47°02'47.2"N  
LONG 122°54'15.3"W

ADJACENT PROPERTY OWNERS:  
DNR, CITY OF OLYMPIA, T&L LLC, WATER  
ST BUILDING LLC, DAVID & SHERI SHAUB,  
MG BURGHAR & ASSOCIATES

NAME: PERCIVAL LANDING SECTION A

REFERENCE #:

SITE LOCATION ADDRESS:  
4TH AVENUE AND WATER STREET NW  
OLYMPIA, WA 98501

PROPOSED: BOARDWALK & FLOATING  
DOCK REPLACEMENT, MAINTENANCE  
DREDGING, AND SHORELINE RESTORATION

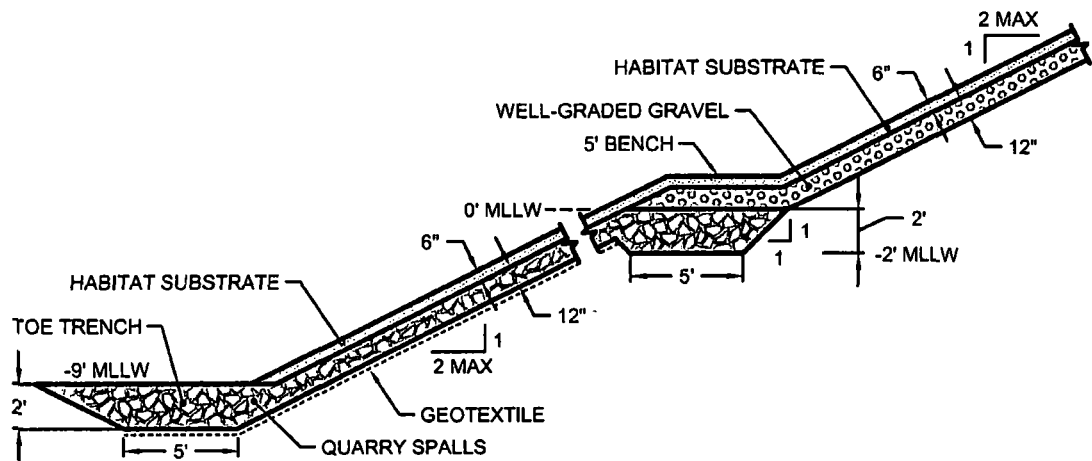
IN: OLYMPIA  
NEAR/AT: WEST BAY  
COUNTY OF: THURSTON  
STATE: WASHINGTON

FIGURE 2

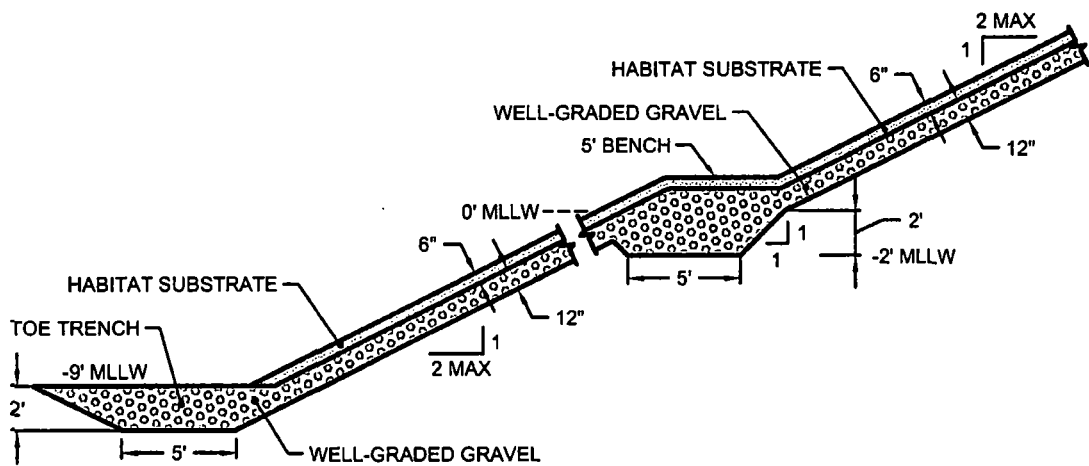
DATE: AUGUST 2009

SHEET: 4 OF 12

K:\Jobs\070487-Percival Landing\07048702\JAPPA\07048702-RP-001.dwg Fig 1  
Apr 09, 2010 3:53pm tgriga



SLOPE PROTECTION DETAIL FROM ORIGINAL DESIGN



REVISED SLOPE PROTECTION DETAIL FOR NORTH OF STATE AVENUE

# APPENDIX G

## HYDRODYNAMIC MODELING

### TIME CRITICAL REMOVAL ACTION

### SAN JACINTO RIVER WASTE PITS

### SUPERFUND SITE

---

**Prepared for**

U.S. Environmental Protection Agency, Region 6

**On behalf of**

McGinnes Industrial Maintenance Corporation

and

International Paper Company

**Prepared by**

Anchor QEA, LLC

614 Magnolia Avenue

Ocean Springs, Mississippi 39564

**September 2010**

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- Figure 16 Proposed Cover Material for the Post-Remedy Cap

**LIST OF ACRONYMS AND ABBREVIATIONS**

<b>Abbreviation</b>	<b>Definition</b>
ADCP	acoustic doppler current profiler
CM	centimeters
CFS	cubic feet per second
DEMs	digital elevation models
EFDC	environmental fluid dynamics code
MHHW	mean higher high water
MHW	mean high water
MLLW	mean lower low water
MSL	mean sea level
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
RMS	root-mean-square
Site	San Jacinto River Waste Pits Superfund Site
TCRA	time-critical action removal
USACE	U.S. Army Corp. of Engineers
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey

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## 1 INTRODUCTION

The San Jacinto River Waste Pits Superfund Site (Site) is located on the western bank of the San Jacinto River, in Harris County, Texas. The Site occupies a 20 acre tract of land immediately north of the Interstate Highway 10 Bridge. The Site is bounded on the south by Interstate Highway 10, on the east by the San Jacinto River main channel, and on the north and west by shallow waters off the river's main channel as shown in Figure 1. A Time-Critical Removal Action (TCRA) will be implemented at the Site to control sediment erosion. The purpose of this report is to describe the development of the hydrodynamic model which was used to predict current velocity and water depths for use in the design of the granular cover materials for the TCRA. This report also presents the methodology that was used to assess the size of the granular cover materials to be used as a cap in the TCRA.

## 2 DESCRIPTION OF TECHNICAL APPROACH

The technical approach involved the development and calibration of a hydrodynamic model for the Lower San Jacinto River that may be used as a diagnostic tool to address questions concerning remedial alternatives for the Site. The hydrodynamic model used in this study is the Environmental Fluid Dynamics Code (EFDC), which is approved and supported by the U.S. Environmental Protection Agency (USEPA). EFDC is a general purpose hydrodynamic model capable of simulating flow in rivers, lakes, reservoirs, estuaries, and coastal oceans. The model solves the conservation of mass and momentum equations, which are the fundamental equations governing the movement of water in a river or lake. Anchor QEA, LLC has applied EFDC to simulate the hydrodynamics in many similar tidal rivers, including the Lower Duwamish River (Seattle, Washington), the Lower Willamette River (Portland, Oregon), and Patrick's Bayou (Deer Park, Texas). A characteristic of EFDC that is of importance for this study is the wetting-drying feature, which makes it possible to realistically simulate the flooding and drying of the intertidal areas. It also allows for the simulation of the inundation of the waste pits during high-flow events. For this study, the model was used in two-dimensional, vertically-averaged mode, which provides for a conservative estimate of the bottom current velocities and shear stresses in the study area. A complete description of EFDC is given in Hamrick (1992).



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The first step of the study was to develop and calibrate the hydrodynamic model. Field studies were conducted to collect data to support the modeling effort, including: high-resolution contour lines collected in 2009 and 2010 representing the bathymetry and topography in the study area and an acoustic doppler current profiler (ADCP) study collected in June and July 2010 where depth-averaged current velocity and stage height were collected at a single location in the vicinity of the study area. The current velocity and stage height were used to calibrate the hydrodynamic model.

After calibration of the hydrodynamic model was completed, high-flow event simulations were conducted to understand under what conditions the waste pits were inundated and understand the velocity forces to aid in the design of the cover material for the TCRA. Specifically, the 5-year, 10-year, and the 100-year high-flow event were evaluated as the design criteria for the study area. Because of the uncertainty of the downstream tidal elevation during the high-flow events, bounding simulations were performed, representing lower- and upper-bound stage height scenarios. The existing condition bathymetry used during model calibration was also used to evaluate the waste pit area for the TCRA.

The primary objective of the cover material is to prevent exposure and erosion of the materials located on the Site while the non-TCRA is being designed and implemented. The cover material was designed using methods developed by the USEPA and the U.S. Army Corps of Engineers (USACE) and presented in "Armor Layer Design of Guidance for In-Situ Subaqueous Capping of Contaminated Sediments" (Maynard 1998).

### **3 HYDRODYNAMIC MODEL DEVELOPMENT**

The model domain for this study extends from about 12 miles downstream of the Lake Houston Dam to the confluence of the San Jacinto River and the Houston Ship Channel, for a total of approximately 7 miles of river. The 2007 Merged Shoreline from the National Oceanic and Atmospheric Administration's (NOAA's) Office of Coast Survey was used as the river shoreline and assigned to the mean high water (MHW) elevation of 0.175 m mean sea level (MSL). The geometry and bathymetry were represented in the model using variable rectangular cell sizes. The grid cell resolution is 15 x 15 meters (m) in the vicinity of the waste pits and gradually increases to 30 x 30 m farther from the study area. This resolution



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was found adequate for the objectives of the modeling study. It represents a balance to adequately simulate hydrodynamic processes and the ability to conduct long-term, multi-year simulations in the future, within a practical processing time for the model.

Model bathymetry and topography used to define existing conditions was obtained from four different sources. Bathymetry outside of the study area was defined from National Ocean Service (NOS) Hydrographic Survey sounding data collected in 2004 within the shoreline. Sounding data consisted of single-beam bathymetric data perpendicular to the channel in variable spacing and transect separation widths, as well as several transects parallel to the river along the navigation channel. Topography outside of the study area was delineated using 10 m resolution digital elevation models (DEMs) from the United States Geological Survey (USGS). Bathymetry and topography inside the study area was defined from two sources representing high resolution contour lines collected in 2009 and 2010. The 2009 survey collected data around a radius of 0.1 miles from the waste pits. The 2010 survey collected data 0.6 miles upstream and 0.2 miles downstream of the waste pits. The more recent 2010 data was used in lieu of the 2009 data, when available. All the data was converted and represented in the MSL vertical datum. The sounding, contour, and DEM data were combined and interpolated in ArcGIS to create a surface map of the bathymetry and topography in the model domain and projected to the numerical grid. A maximum topographic elevation of +7 m MSL was selected to define the conservative maximum inundation level of the flood plain during the high-flow events. Thus, a total of approximately 32,400 active horizontal cells were modeled. Figure 2 and 3 show the numerical grid and projected bathymetry for the entire domain and study area, respectively.

The model has two boundary conditions that need to be specified: 1) upstream inflow near the Lake Houston Dam; and 2) downstream water level (tidal elevation) for the confluence between the San Jacinto River and the Houston Ship Channel. Flow rate data was available at the Lake Houston Dam from the Coastal Water Authority for a 3-year period between 2007 and 2009 (Mike Kent, personal communication, January 2010). To develop a longer term period of the historical flow record, daily average flow rates at the Dam were estimated for the 25-year period between 1985 and 2009. The flow rates were estimated by summing up the flow data from the seven upstream USGS gages and prorating the summed flow by the

ratio of the drainage area at the Dam (2,828 square miles, mi<sup>2</sup>) to the sum of the drainage areas of the seven upstream gages (2,075 mi<sup>2</sup>). This represents a proration factor of about 1.4. A list of the USGS gages used and the corresponding drainage areas are shown in Table G-1.

**Table G-1**  
**List of USGS Streamflow Gage Locations and Corresponding Drainage Areas Used to Estimate the Long-Term Historical Flow Rate at the Lake Houston Dam**

USGS Gage Number	Location Name	Drainage Area (mi <sup>2</sup> )
08071280	Luce Bayou above Lake Houston near Huffman, TX	218
08070200	East Fork San Jacinto River near New Caney, TX	388
08070500	Caney Creek near Splendora, TX	105
08068090	West Fork San Jacinto River above Lake Houston near Porter, TX	962
08069000	Cypress Creek near Westfield, TX	285
08068500	Spring Creek near Spring, TX	117

The location of each of the USGS gage stations are shown on the map in Figure 4. A comparison of the daily average flow rates between the estimated values and actual values from the Dam was performed for the common period between 2007 and 2009. Figure 5 shows a one-to-one plot of the flow rates in the top panel and cumulative frequency distribution comparison in the bottom panel. This analysis indicates that the two records are reasonably similar.

Inflows at the upstream boundary during high-flow events were specified based on the results of a flood frequency analysis. A Log-Pearson Type 3 flood frequency analysis (Helsel and Hirsch 2002) of daily-average flow rate data from the estimated 25-year long-term historical record was conducted. The Log-Pearson Type 3 analysis is the recommended technique for flood frequency analysis (IACWD 1982). The results of this analysis are presented on Figure 6, which show flow rates for return periods between 2- and 100-years. As required by USEPA in the decision document (USEPA 2010), the 5-year, 10-year, and 100-year high-flow events were used for the design of the cover system. The 100-year flood

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is approximately 372,000 cubic feet per second (cfs). Flows of this magnitude have occurred in the San Jacinto River. For example, on October 19, 1994, a flow rate of 356,000 cfs was measured in the San Jacinto River near Sheldon, Texas, which was estimated to exceed the 100-year flow rate, according the United States Geological Survey (USGS 1995).

The water surface elevation at the downstream boundary was obtained from two nearby NOAA tidal gage stations as shown in Figure 7. The NOAA tidal gage station 8770743 (Battleship Texas State Park, Texas) is the closest, located on the Houston Ship Channel, within a mile of the confluence with the San Jacinto River. Long-term historical hourly measured data is only available for the month of September 2005 from this gage. A 15-day subset of this period was used for the high-flow event simulations. To incorporate the uncertainty in the tidal elevation during high-flow events, a bounding calculation was performed. The upper-bound stage height conditions were estimated as the base case stage height plus the difference between the mean higher high water (MHHW) and mean sea level at this location. This represents an increase of 0.67 feet. The lower-bound stage height conditions were estimated as the base case stage height minus the difference between the mean lower low water (MLLW) and mean sea level. This represents a decrease of 0.79 feet. The base case, lower-bound, and upper-bound stage height conditions are shown in Figure 8. Tidal data used during the calibration period was obtained from another nearby location, NOAA gage station 8770613 (Morgans Point, Texas). This station is located approximately 12 miles southeast of the Battleship State Park gage station. Measured hourly stage height data is available at this location for the 18-year period between 1993 and 2010. To ensure that the tidal elevations from the two stations are similar, a comparison was made for the September 2005 period, as shown in Figure 9.

#### **4 CALIBRATION APPROACH AND RESULTS**

Calibration of the hydrodynamic model was achieved using ADCP data collected in the main channel, adjacent to the study area. The ADCP data consisted of water surface elevation, depth-averaged current velocity data, and east-west and north-south components of velocity collected in two minute intervals during the 21-day period between June 16 and July 6, 2010. The ADCP location, shown in Figure 10, was selected because of accessibility from the study area and because the location was totally submerged during the entire calibration period.

The upstream inflow and downstream tidal elevation for the calibration period is shown in Figure 11. During the calibration period, total freshwater inflow in the river had a maximum peak value of about 21,000 cfs, which corresponds to a high-flow event with a return period of approximately 1.3 years. The model parameter that was adjusted to achieve the optimum agreement between predicted and observed water surface elevation and current velocity was the effective bed roughness ( $z_0$ ) in the hydrodynamic model, which represents the total roughness due to form drag and skin friction. Generally,  $z_0$  ranges from about 0.1 to 10 centimeters (cm).

A value of 0.1 cm for total effective bed roughness produced the best agreement between observed and predicted water surface elevation and depth-averaged current velocity during the calibration period (Figure 12). Overall the results from the calibration indicate that the hydrodynamic model is able to adequately simulate the water surface elevation and current velocity in the San Jacinto River for a wide range of freshwater inflow and tidal conditions. The average absolute and root-mean-square (RMS) errors for the water surface elevation and current velocity during the calibration period are listed in Table G-2.

**Table G-2**  
**Results of Error Analysis for Hydrodynamic Model Calibration Period**

Model Output	Average Absolute Error	RMS Error
Water surface elevation (ft)	0.11	0.15
Current velocity (cm/s)	8.6	11

## 5 EVALUATION OF TCRA REMEDIAL SCENARIO

After successful calibration of the model, high-flow event hydrodynamic simulations were conducted using the current condition bed elevations as shown in Figure 3. Predicted current velocities within the study area were used to calculate the median particle diameter ( $D_{50}$ ) for the cover material.

Using a constant upstream flow rate, the 5-year, 10-year, and 100-year high-flow events were simulated for a 15-day period in September 2005 using the upper- and lower-bound

tidal elevations. Results indicated that the lower-bound tidal elevations provided a more conservative prediction of the maximum current speeds within the study area. Figures 13, 14, and 15 show the spatial distribution of the predicted maximum current speeds in the study area during each event.

The method presented in Maynard (1998) is based on the USACE's "Hydraulic Design of Flood Control Channels" (USACE 1994). This method uses velocity and flow depth computed by the depth-averaged hydrodynamic model to determine the size of the granular cover material that will be stable for a given current velocity.

Equation 2 from Maynard (1998) is:

$$D_{50} = S_f C_s C_v C_T C_G d \left[ \left( \frac{\gamma_w}{\gamma_s - \gamma_w} \right)^{\frac{1}{2}} \frac{V}{\sqrt{K_1 g d}} \right]^{2.5}$$

Where

- $D_{50}$  = median particle size in feet
- $S_f$  = safety factor
- $C_s$  = stability coefficient for incipient failure
- $C_v$  = velocity distribution coefficient
- $C_T$  = blanket thickness coefficient
- $C_G$  = gradation coefficient =  $(D_{85}/D_{15})^{1/3}$
- $D_{85}/D_{15}$  = gradation uniformity coefficient
- $d$  = water depth in feet (from the hydrodynamic model)
- $\gamma_s$  = unit weight of stone
- $\gamma_w$  = unit weight of water
- $V$  = maximum depth-averaged velocity in feet per second (from the hydrodynamic model)
- $K_1$  = side slope correction factor
- $g$  = acceleration due to gravity

Figure 16 presents the computed maximum stable particle size in each model grid cell over the Site for all events simulated.

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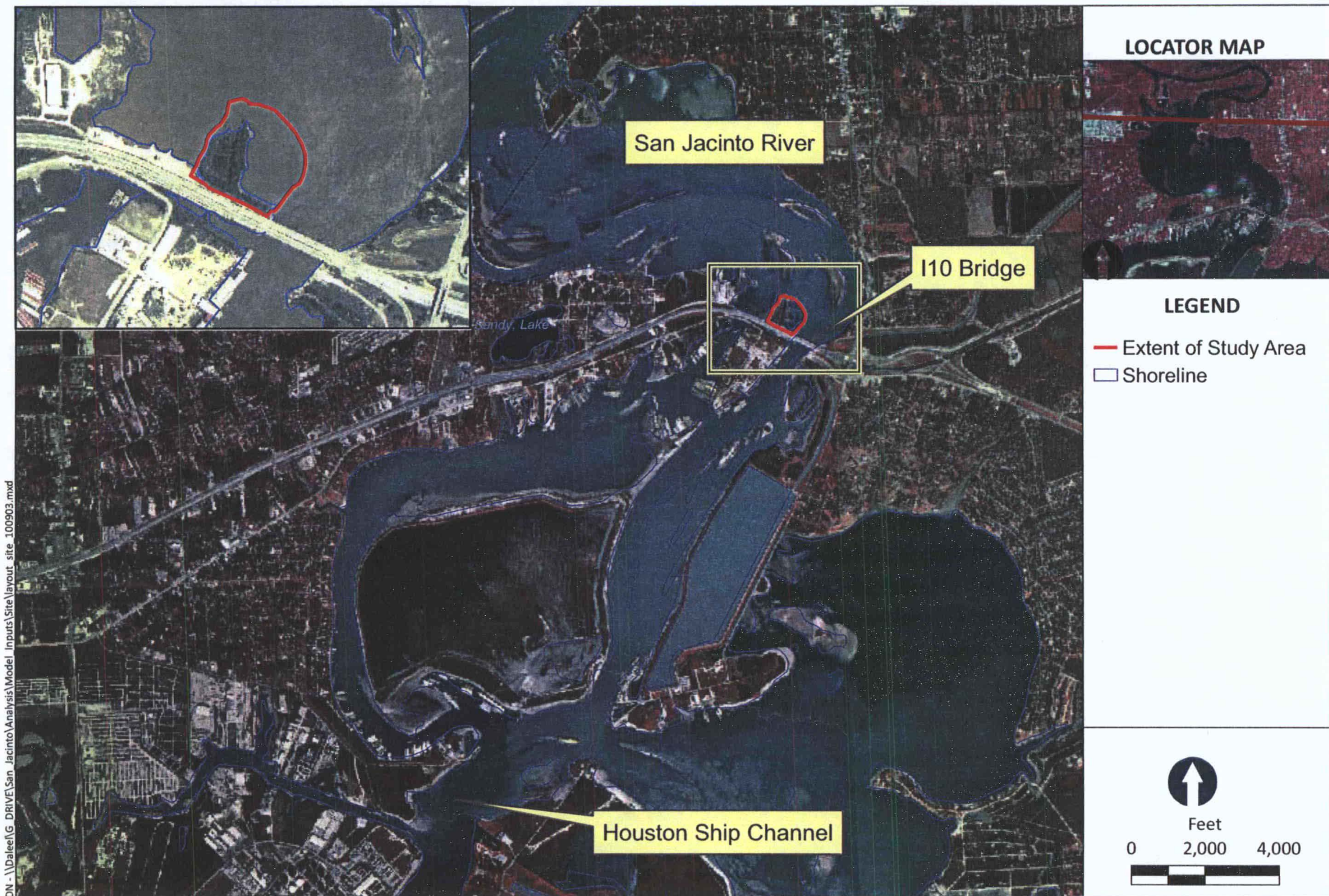
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## FIGURES

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DN - \\dalee\G\_DRIVE\San Jacinto\Analysis\Model Inputs\Grid\layout\_grid\_current\_conditions\_100903.mxd

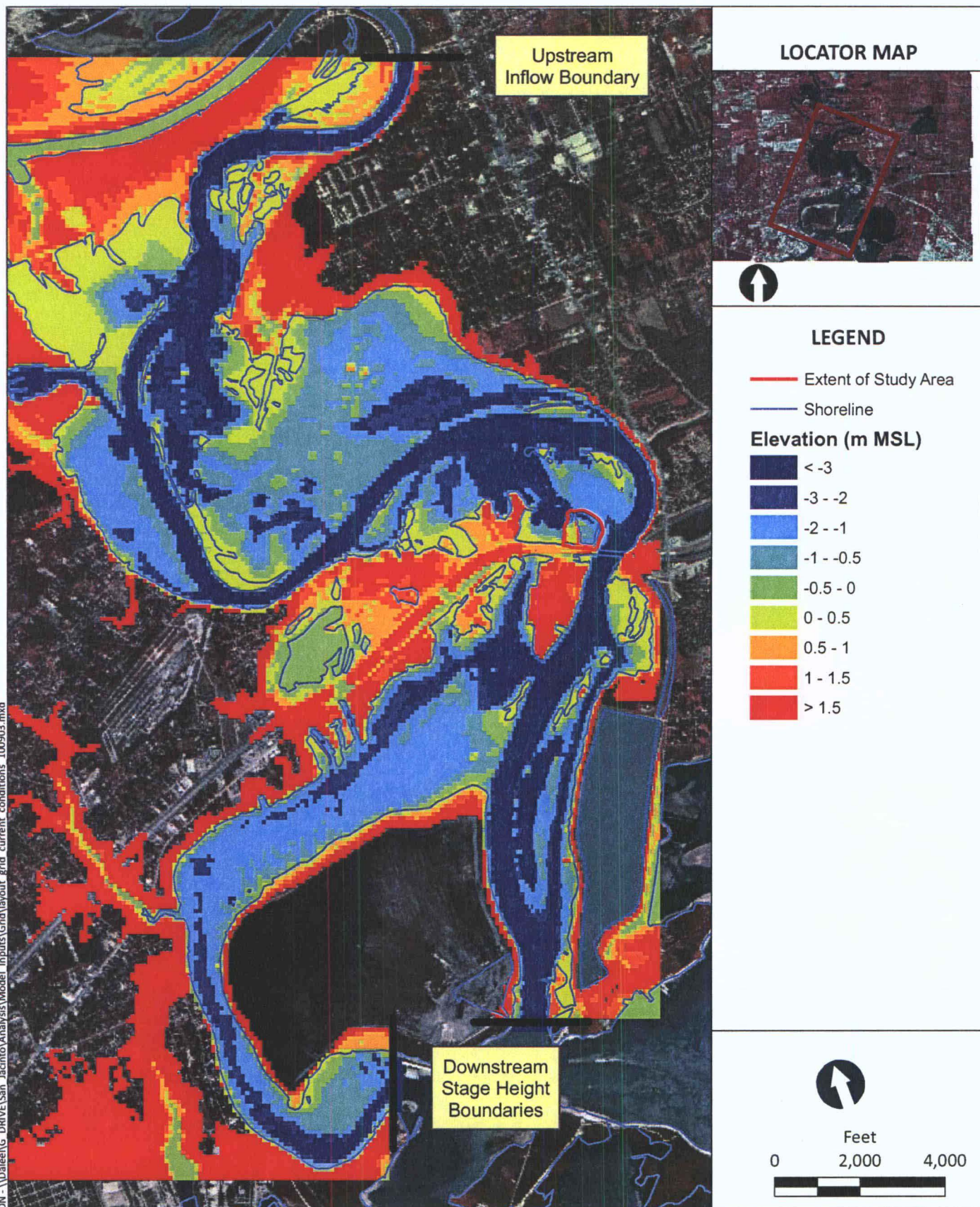
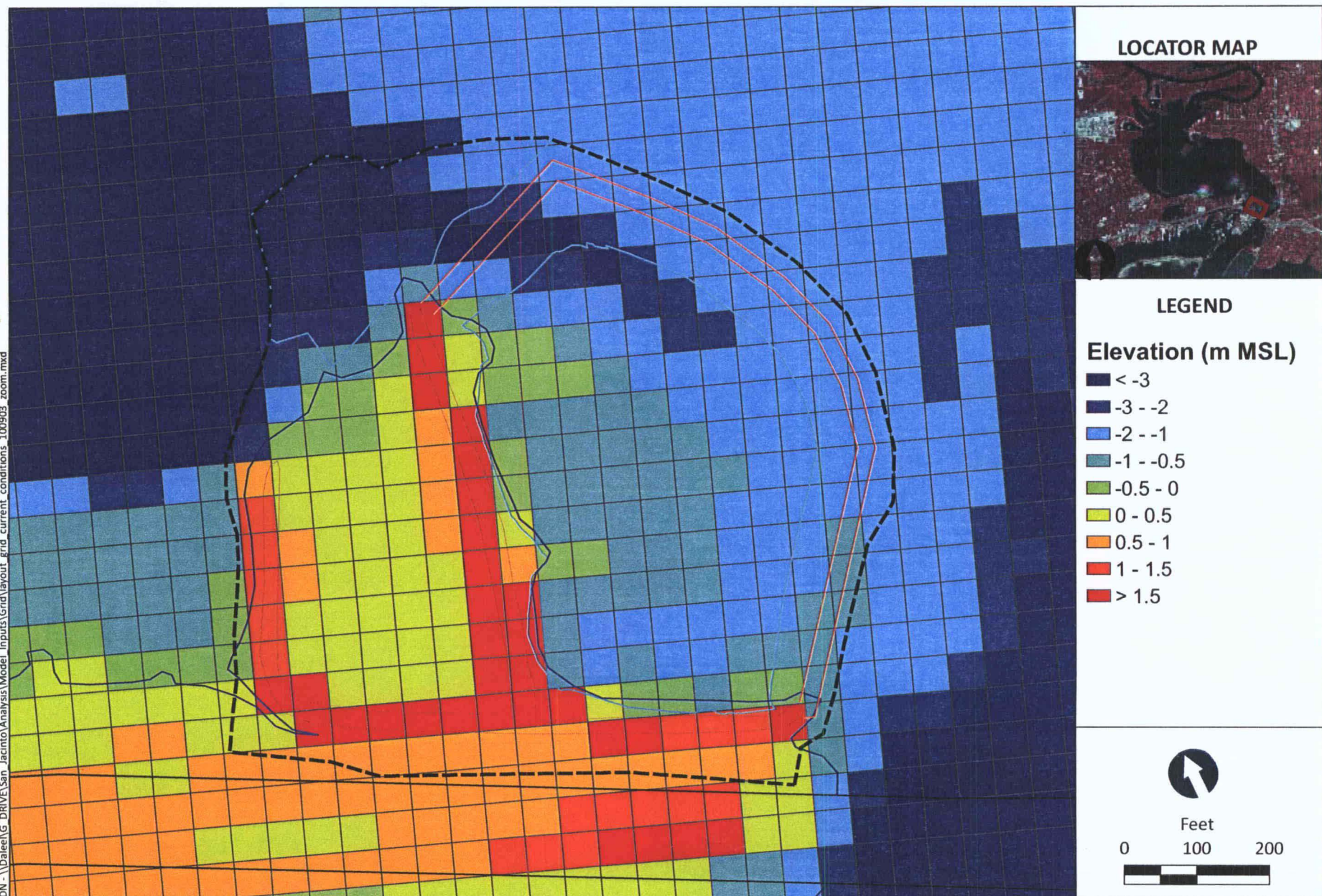


Figure 2

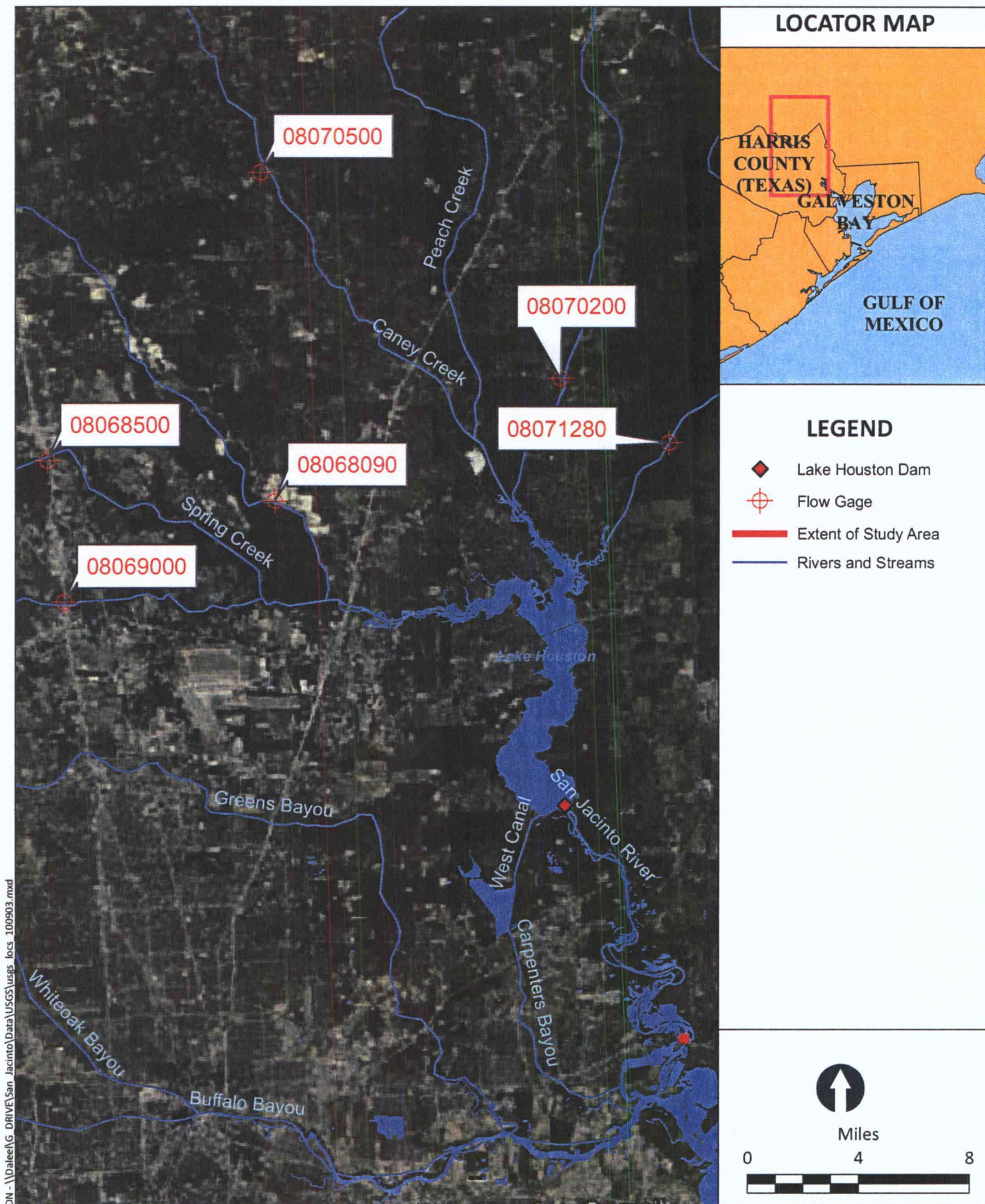
Numerical Grid and Projected Bathymetry in the Entire Model Domain for Current Conditions San Jacinto River Study Area



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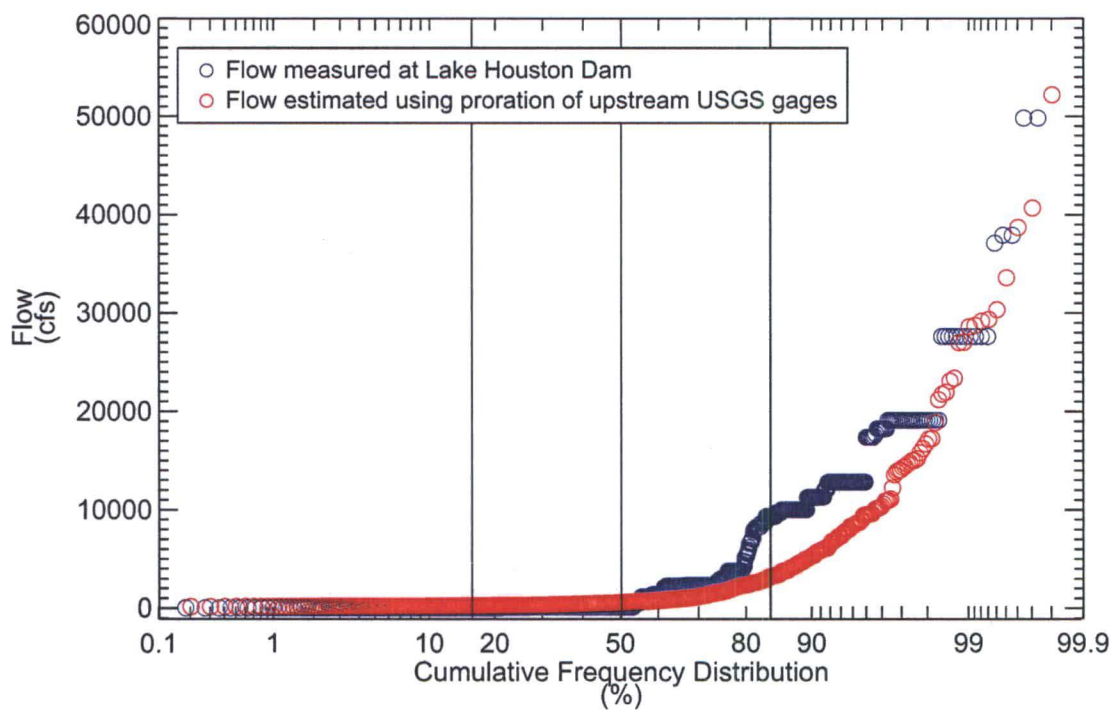
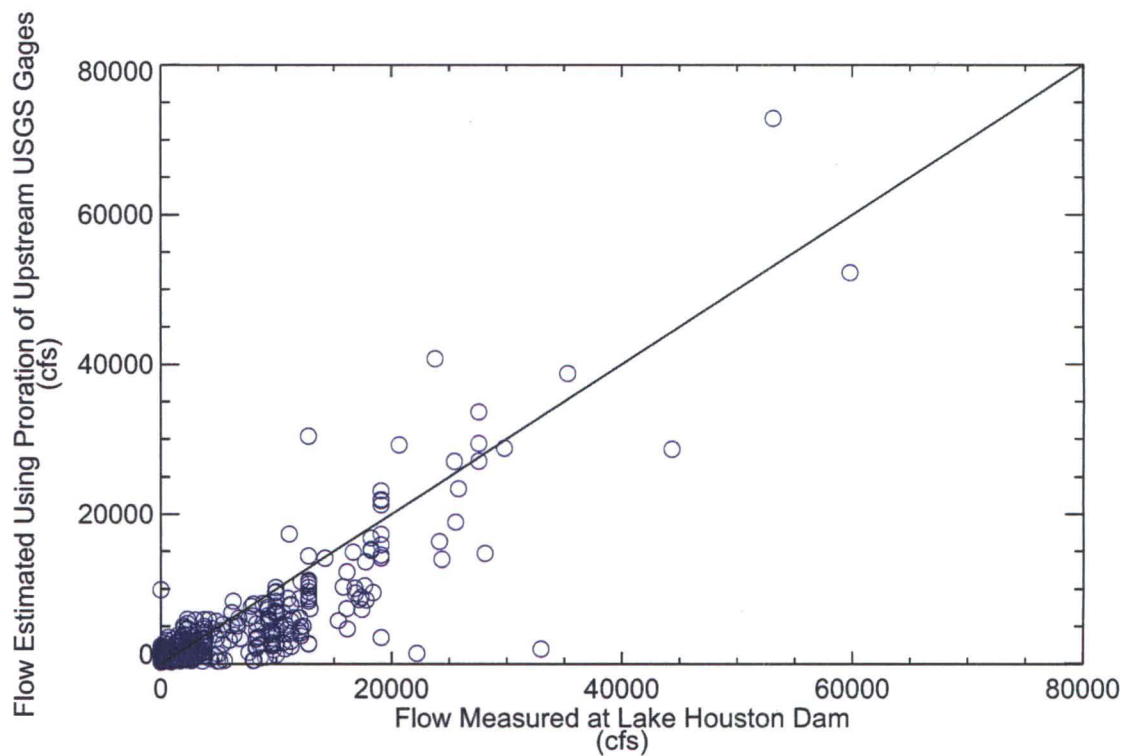






**Figure 4**

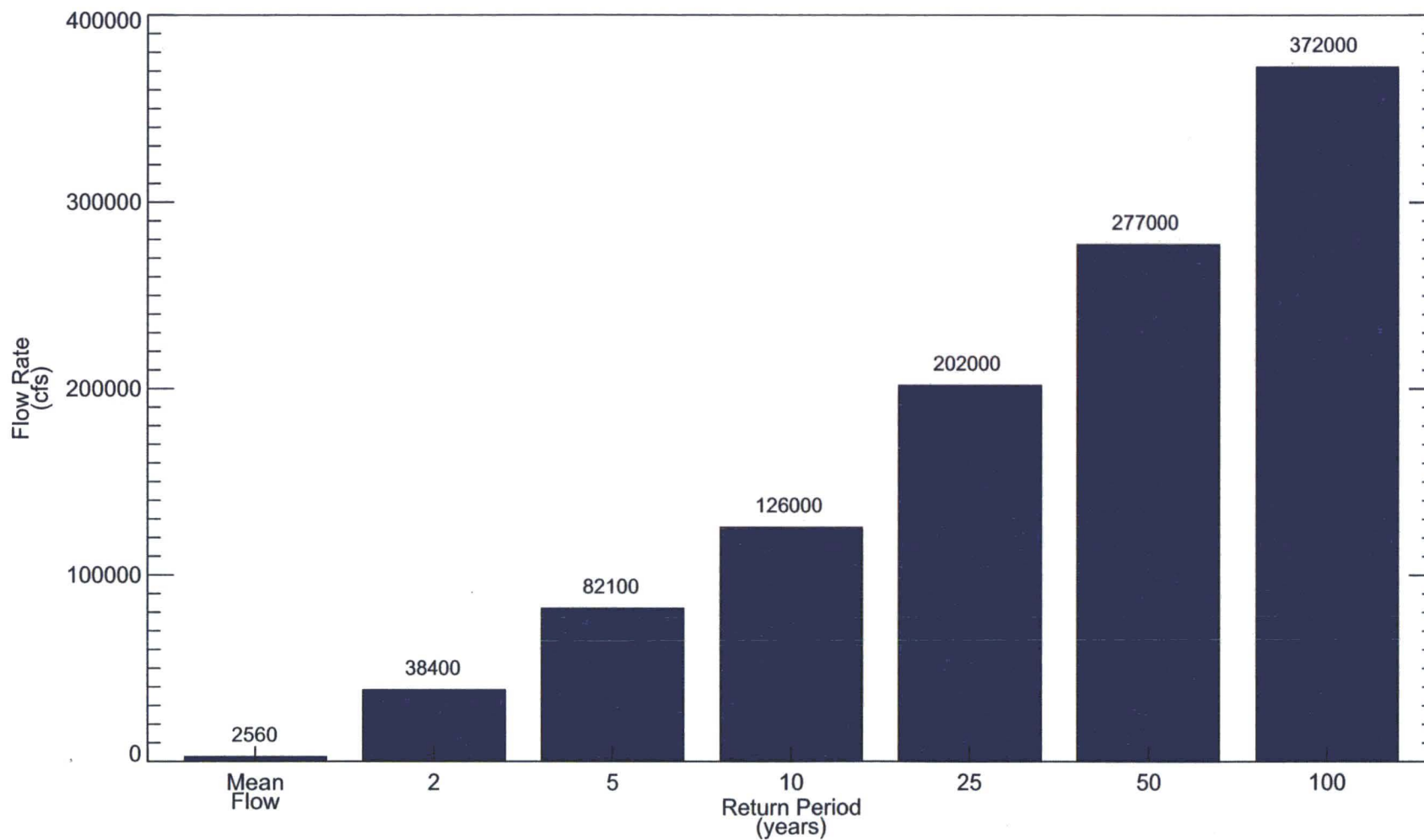
Locations of USGS Gage Stations Used to Estimate  
Long-Term Historical Flow at the Lake Houston Dam  
San Jacinto River Study Area



**Figure 5**

Comparison of Historical Daily-Average Flow Rate at the Lake Houston Dam and the Estimated Flow Rate from the Six Upstream USGS Gages San Jacinto River Study Area

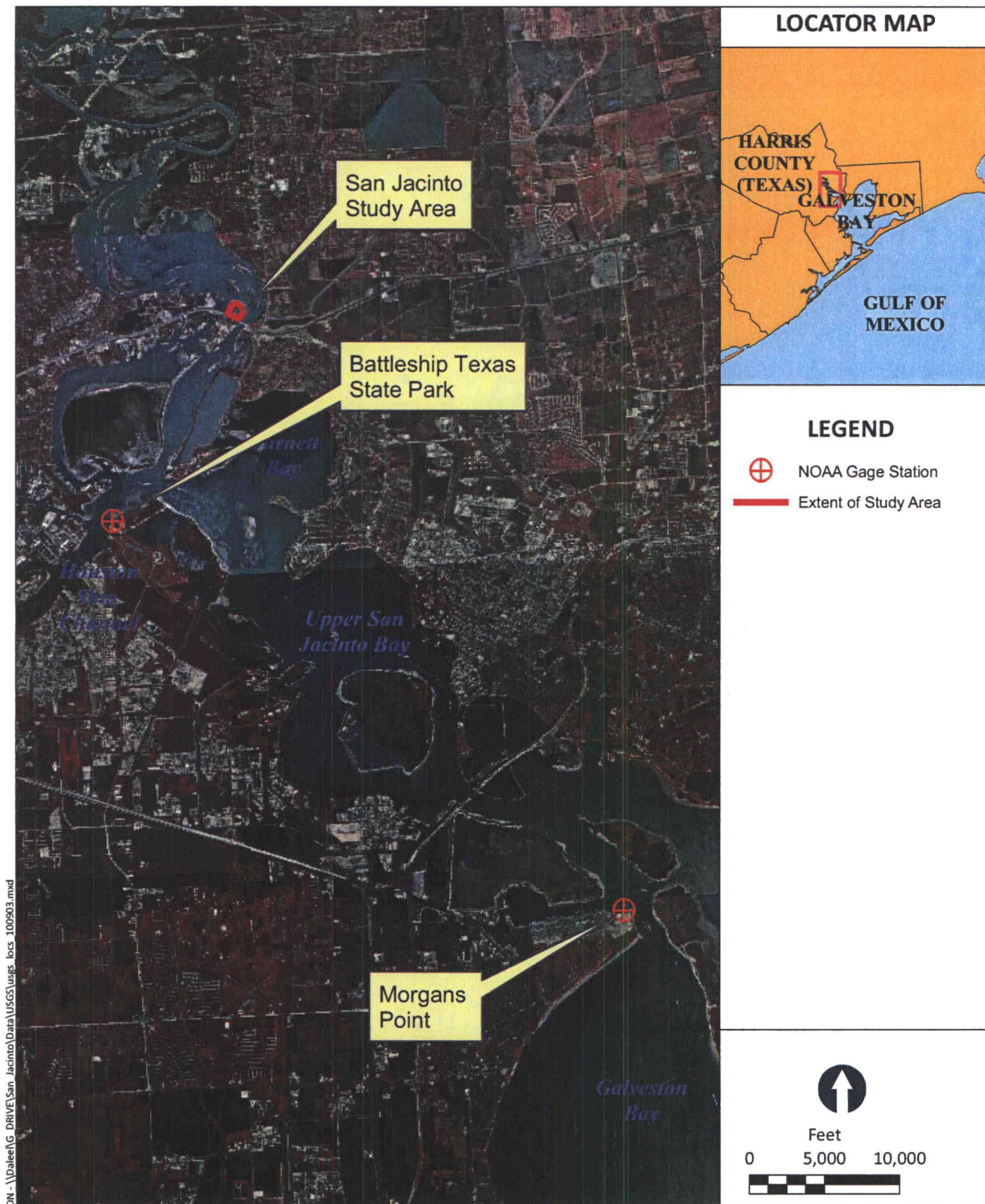




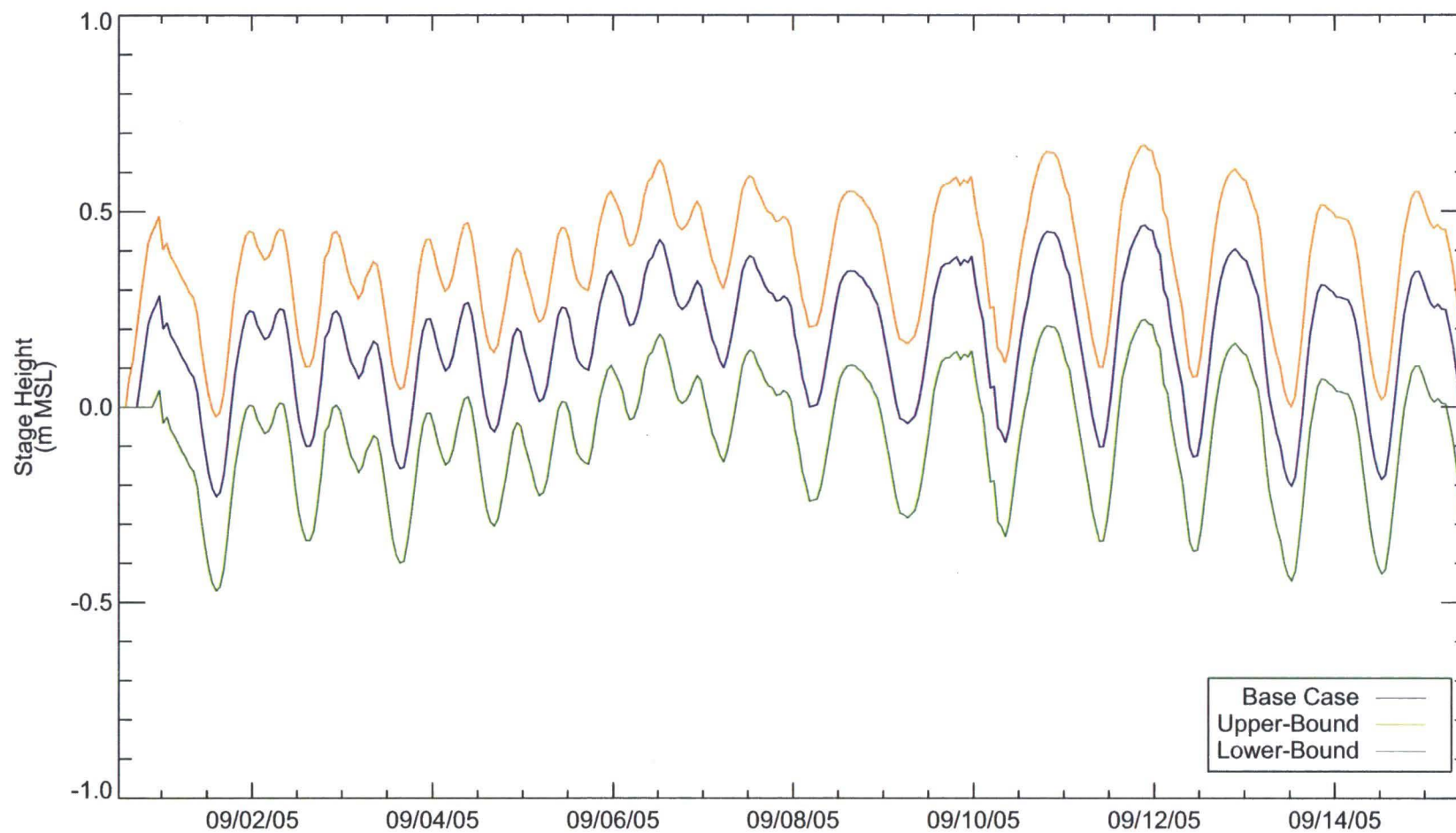
**Figure 6**

Flood Frequency Analysis for Lake Houston, Using Sum of Flows at Upstream USGS Gages  
San Jacinto River Study Area





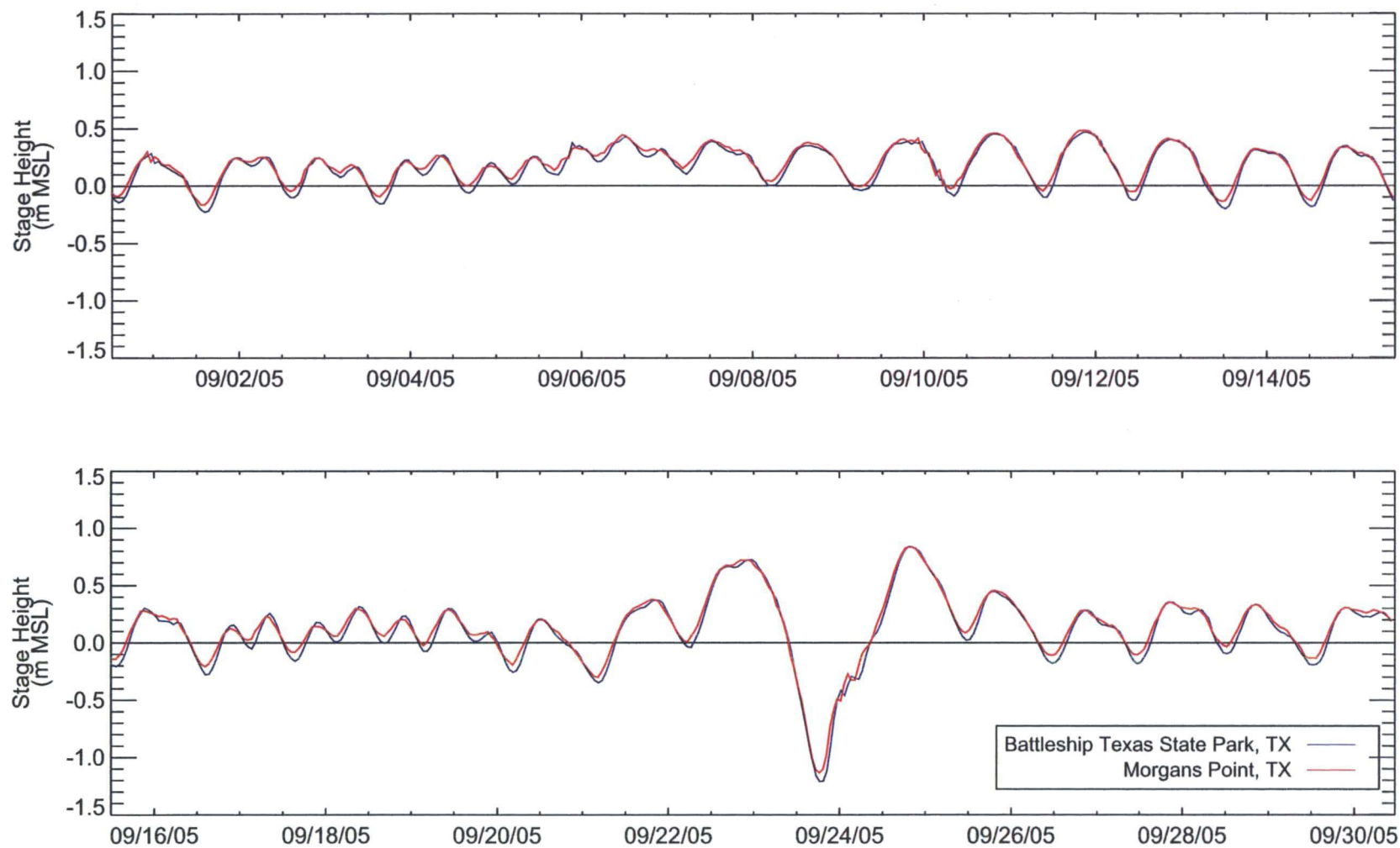




**Figure 8**

Base Case, Lower-Bound, and Upper-Bound Stage Height Conditions for 15-Day Period  
in September 2005 Used in the High-Flow Event Simulations  
San Jacinto River Study Area



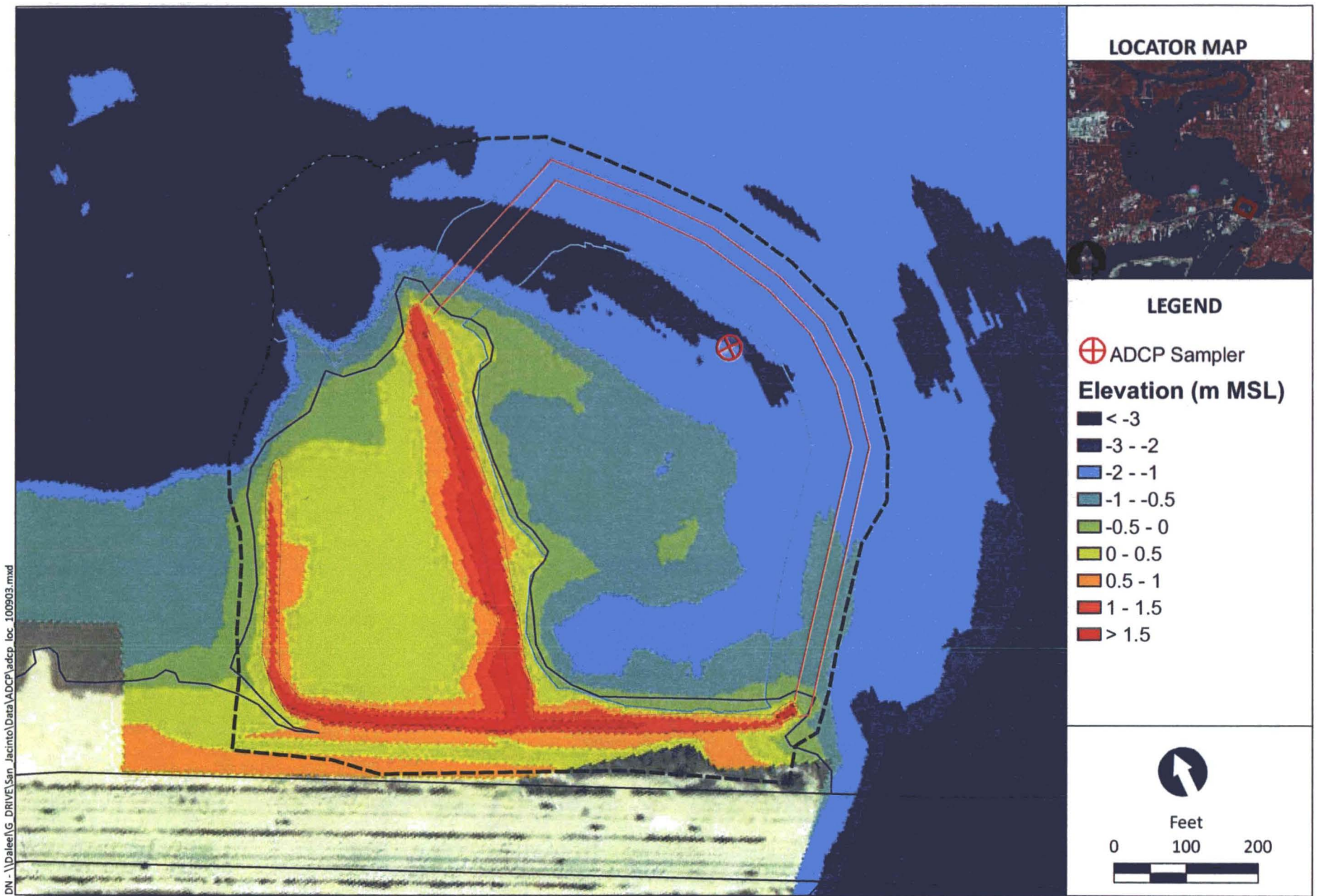


**Figure 9**

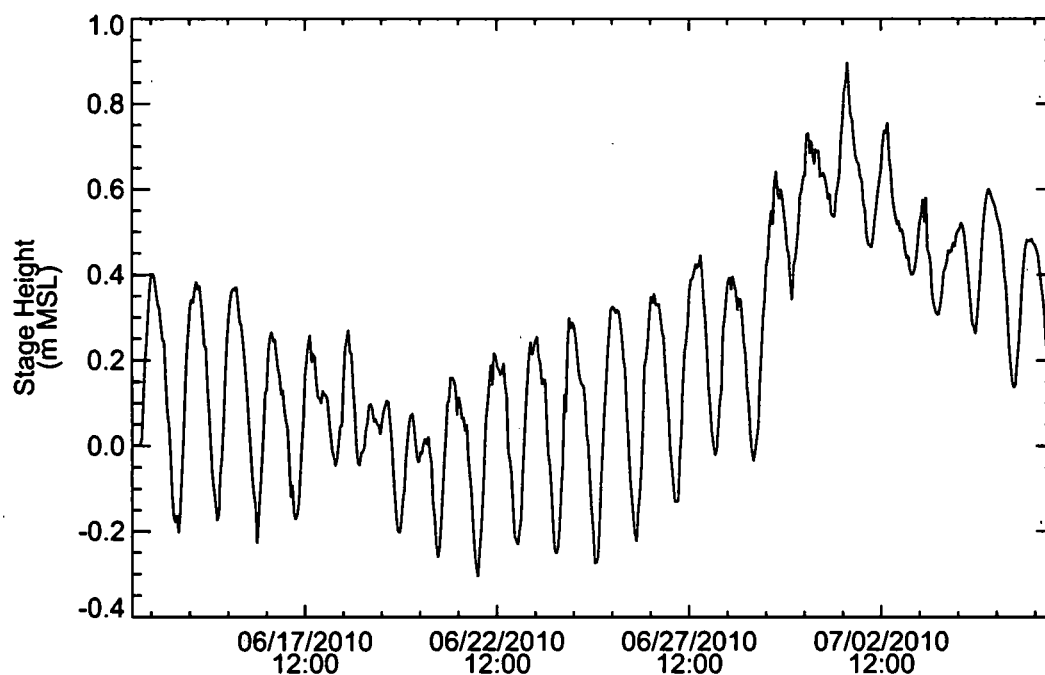
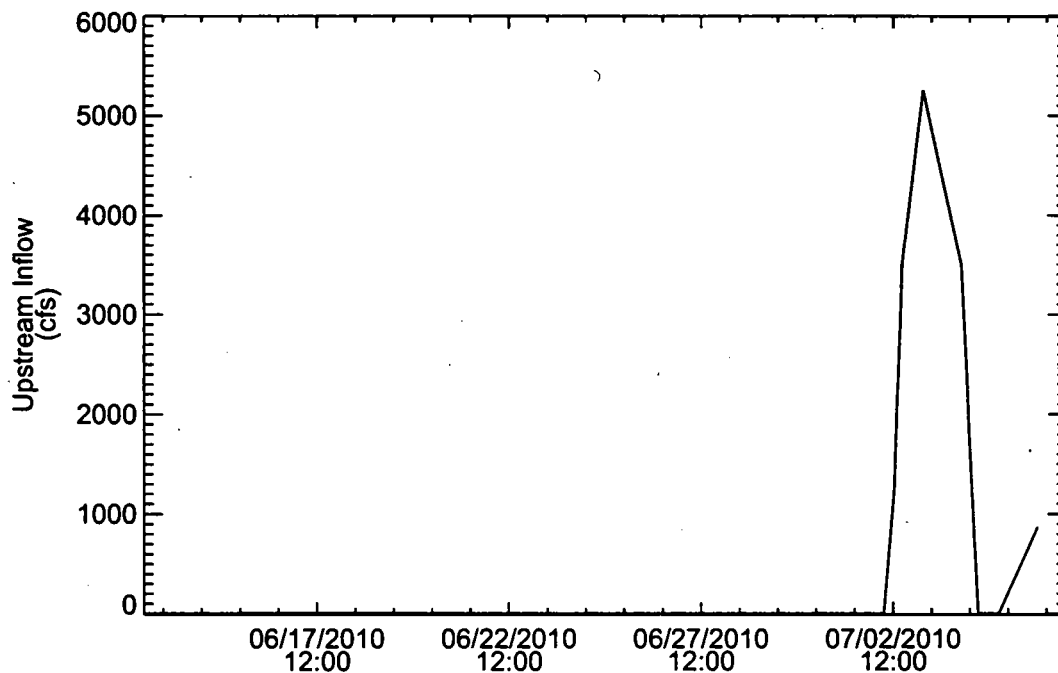
Comparison of Measured Stage Height at Battleship Texas State Park, TX and  
Morgans Point, TX During September 2005  
San Jacinto River Study Area





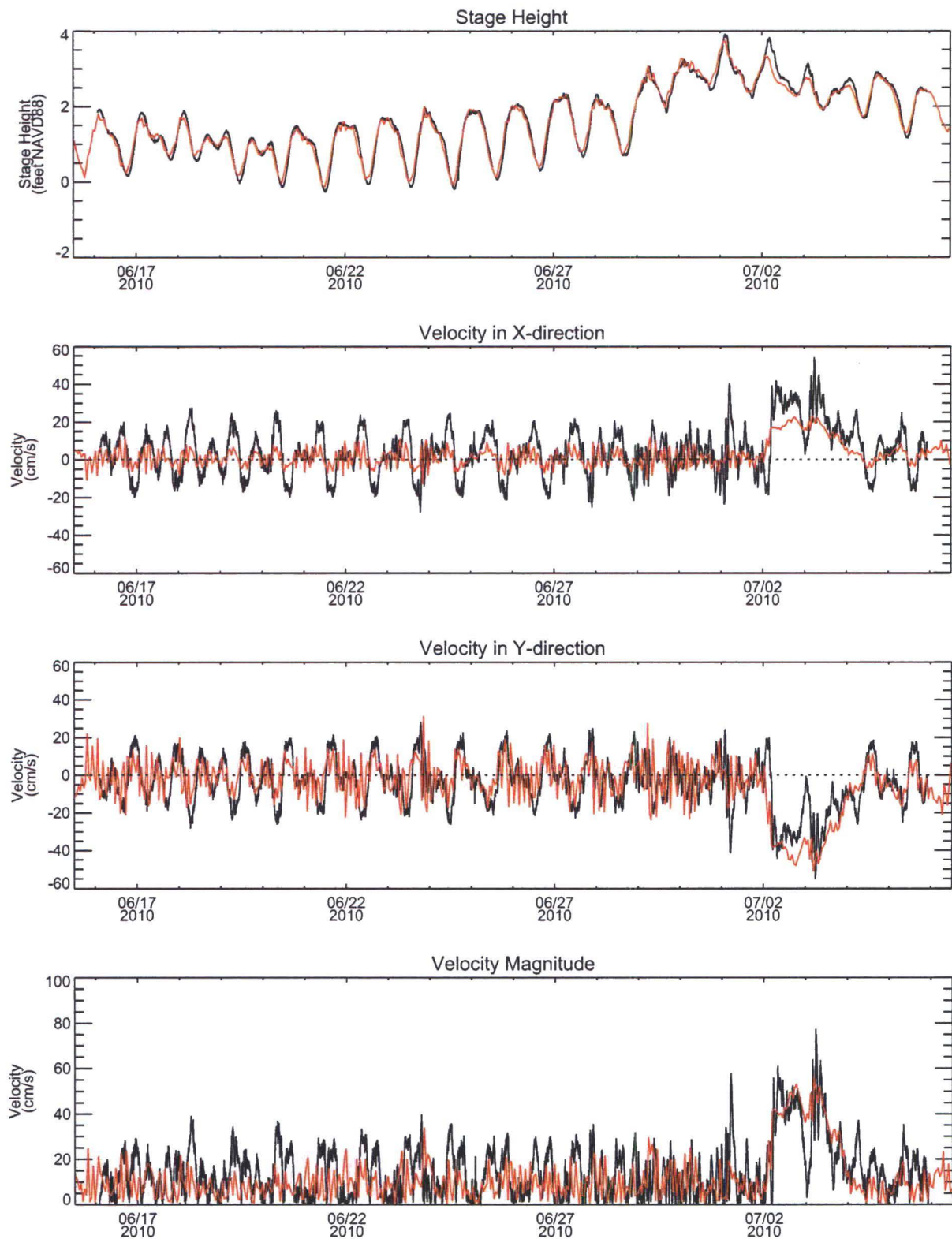


**Figure 10**  
Location of ADCP Sampler During the Calibration Period  
San Jacinto River Study Area



**Figure 11**

Upstream Inflow and Downstream Stage Height During the Calibration Period  
San Jacinto River Study Area

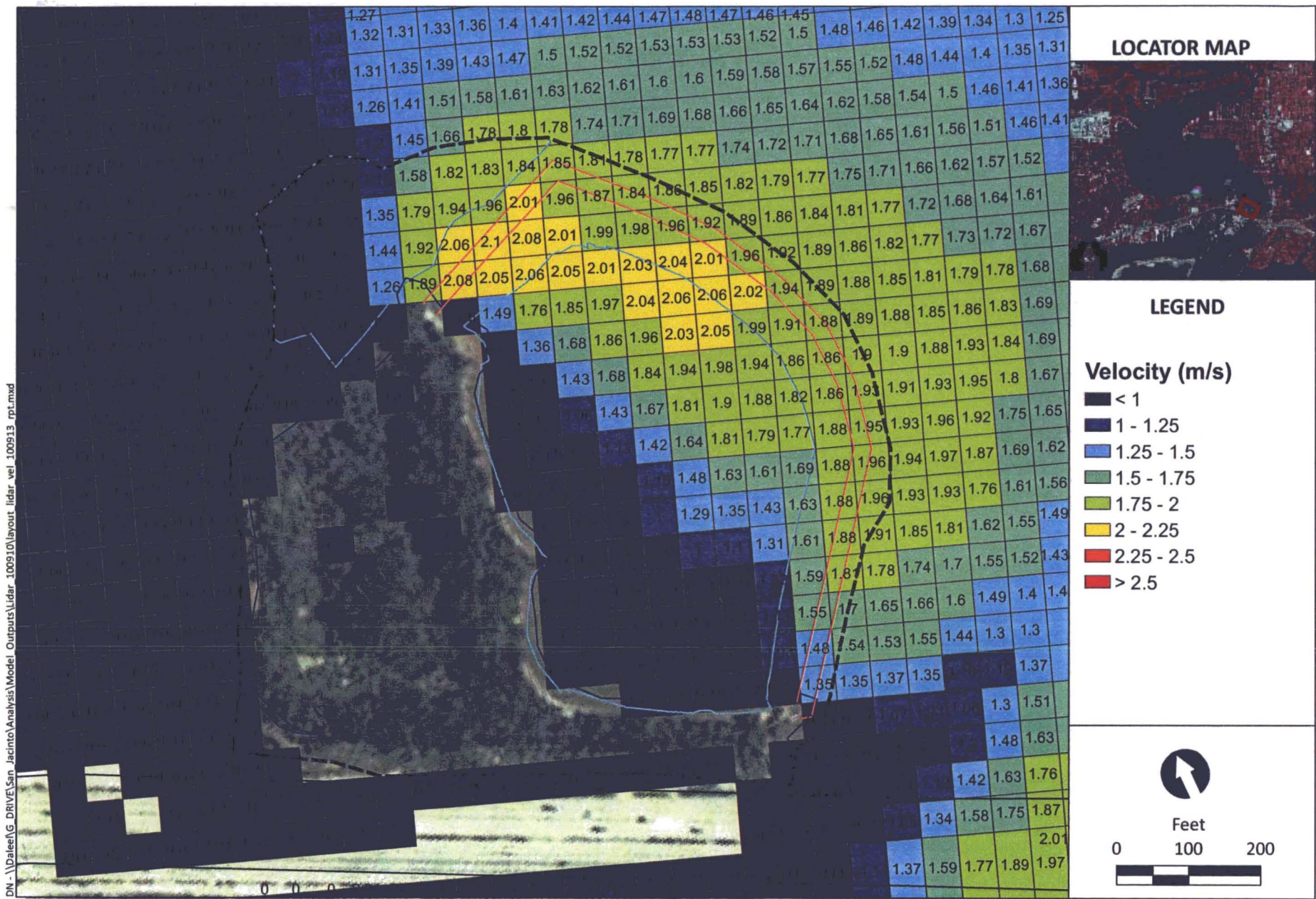


**Figure 12**

Model-Data Comparison of Water Surface Elevation  
and Depth-Averaged Current Velocity During  
June/July 2010 Calibration Period  
San Jacinto River Study Area





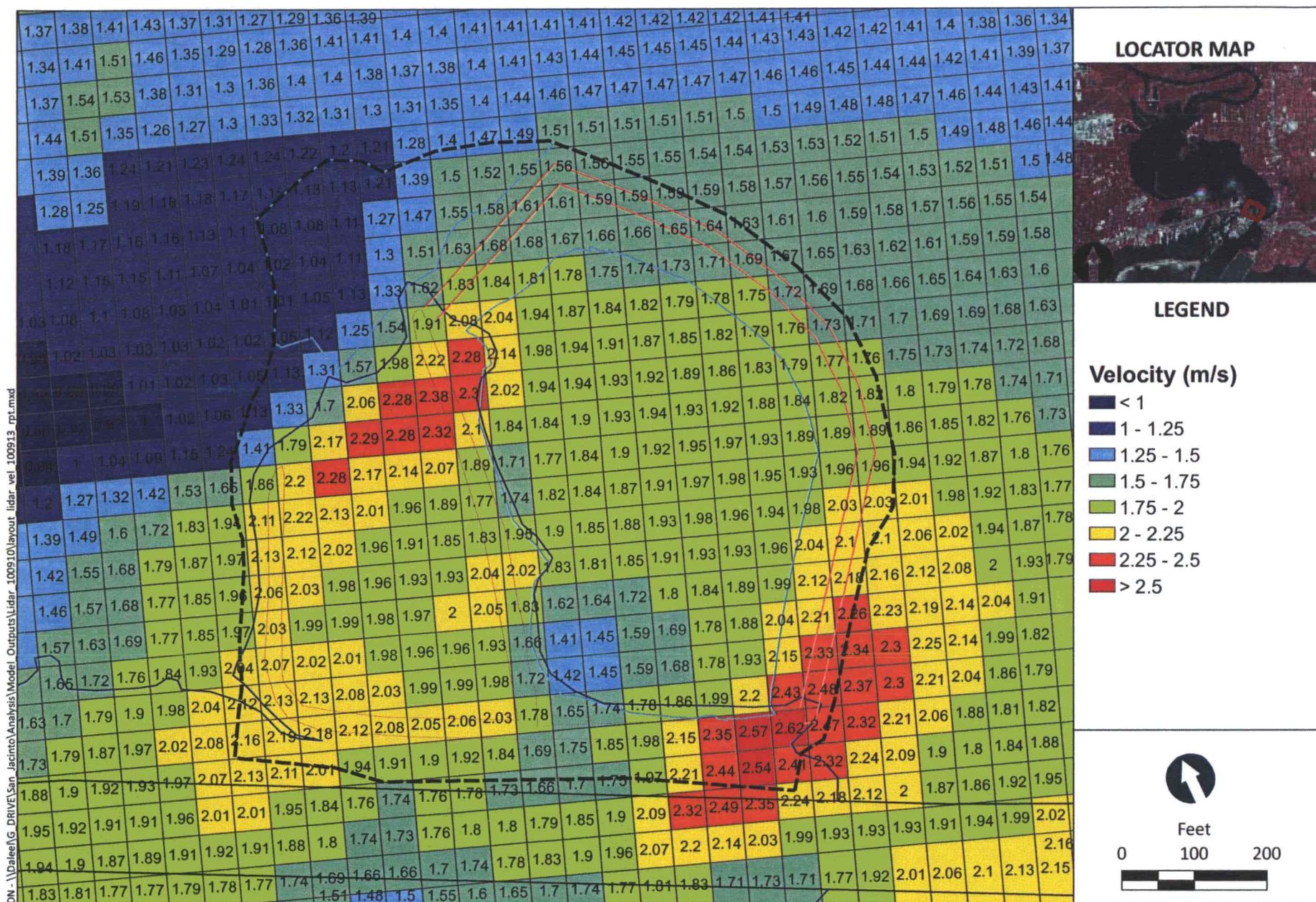


**Figure 13**  
Spatial Distribution of Maximum Current Speeds During the 5-Year High-Flow Event  
San Jacinto River Study Area





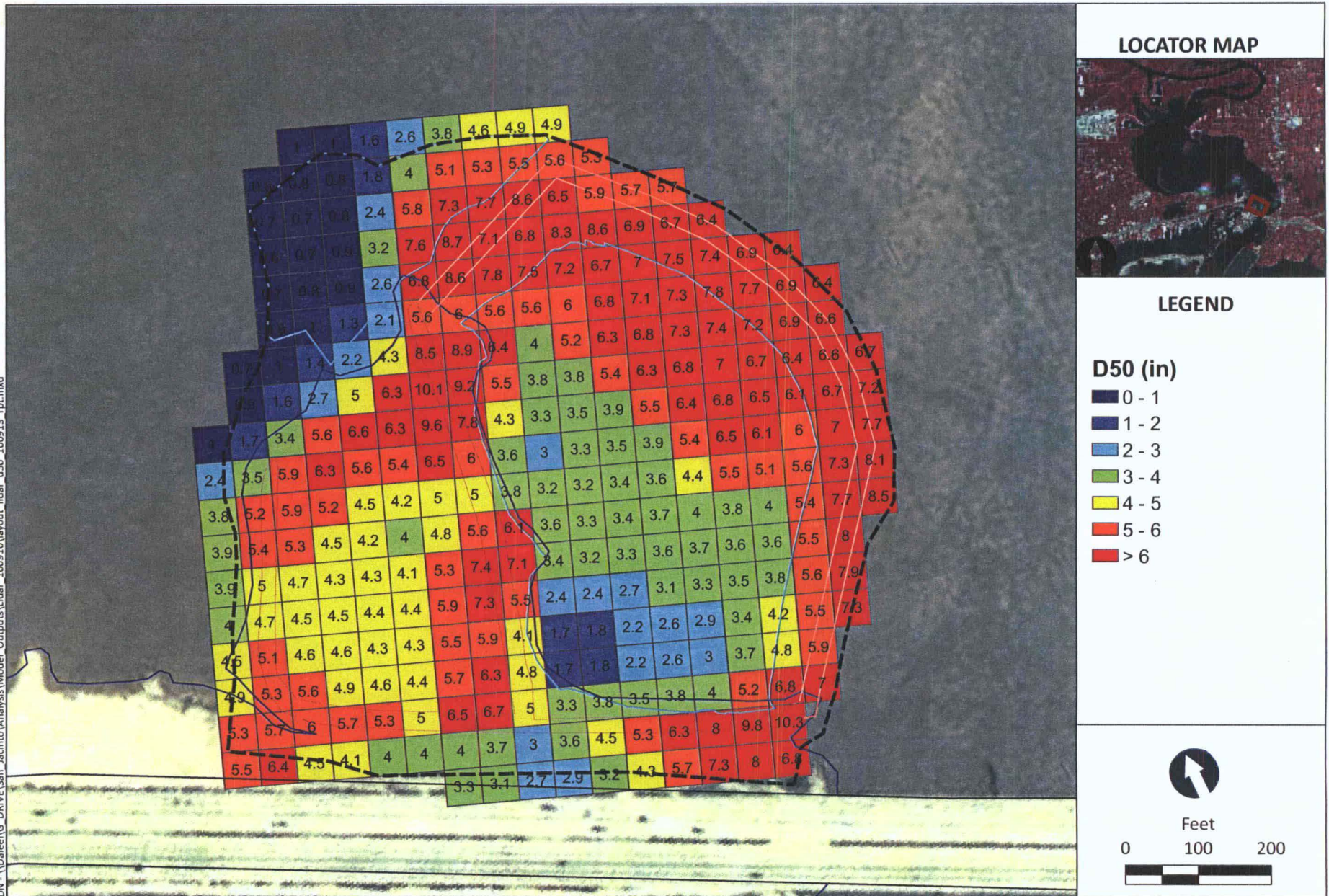




**Figure 15**  
Spatial Distribution of Maximum Current Speeds During the 100-Year High-Flow Event  
San Jacinto River Study Area



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# APPENDIX H

## GEOTECHNICAL ENGINEERING ANALYSES

### TIME CRITICAL REMOVAL ACTION SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

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**Prepared for**

U.S. Environmental Protection Agency, Region 6

**On behalf of**

McGinnes Industrial Maintenance Corporation

and

International Paper Company

**Prepared by**

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614 Magnolia Avenue

Ocean Springs, Mississippi 39564

**September 2010**

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## LIST OF ACRONYMS AND ABBREVIATIONS

Abbreviation	Definition
GLE	general limit equilibrium
RAWP	Removal Action Work Plan
SJRWPS	San Jacinto River Waste Pits Superfund Site (Site)
SPT	standard penetration test
TCRA	Time Critical Removal Action
VST	vane shear test

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## 1 INTRODUCTION

This report summarizes geotechnical explorations, Site geotechnical conditions, and geotechnical engineering analyses performed in support of the design of the Time Critical Removal Action (TCRA) for the San Jacinto River Waste Pits (SJRWPs) site (Site), located in Harris County, Texas. The following information is discussed:

- Subsurface conditions
- Bearing capacity of sediments
- Slope stability
- Filter design

### 1.1 Subsurface Conditions

Field explorations at the Site consist of 11 in-water borings. These borings were conducted using a barge mounted rotary drill rig. Samples were obtained by driving a split spoon sampler using the standard penetration test (SPT) or pushing a Shelby tube.

In addition to the explorations, the shear strength of surface sediments was measured using the Vane Shear Test (VST) at 18 locations. At each test location, the vane shear device was used to measure peak and residual undrained strength at 1-foot-, 2-foot-, and 3-foot-depth intervals below the mudline. Peak shear strengths in the upper one-foot-interval ranged from 38 to 440 psf for the 23 tests, with an average of 160 psf. The average undrained shear strengths of the two- and three-foot depth intervals were 240 and 320 psf, respectively.

Figure H-1 presents the locations of the borings and VST. Table H-1 summarizes the results of the VST.

The field explorations encountered a general soil sequence interpreted as shown in Figure H-2 and consisted of the following major soil units from the mudline downward:

**Soft silt and clay.** The upper sediment layer of each boring consisted of varying, stratified deposits of soft silt and clay, with occasional layers of sand. This layer varies in color from gray, to brown, to almost black and contains varying amounts of organic fibers, from trace to abundant. Large shells were found on the surface across most of the Site. This soft clay and

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silt was observed up to an elevation of -26 feet NAVD88, and ranges in thickness from 13 to 22 feet.

**Light gray sand.** At most locations, underlying the soft silt and clay, was a layer of loose to medium dense, light gray sand. This sand layer is generally slightly silty, with fine- to medium-grained, sub-rounded particles. Occasionally, interbeds of gray clay were observed within this unit. The light gray sand unit ranges in thickness from 6 to 16 feet and was observed from elevations -12 to -34 feet NAVD88. Occasionally this layer was not observed in a boring when the soft clay transitioned directly to a thick layer of hard clay.

**Beaumont clay.** A hard, dry to damp, clay layer was observed from approximate elevations -24 to -65 feet NAVD88, and ranging in thickness from 27 to 41 feet. This material was light reddish-brown in color and graded to light-bluish-gray with depth. There was an occasional trace of sand and silt in the reddish-brown clay. Generally, the light bluish-gray clay graded to sandy clay to clayey sand with less plasticity with depth. In boring SJGB003, from elevation -65 to -107 feet NAVD88, the clay layer was observed considerably deeper than other borings and was observed alternating between dark and light gray and with a trace of wood fragments throughout.

**Very dense sand.** In borings SJGB002, SJGB003, SJGB005, SJGB007, and SJGB008, underneath the hard clay layer, a unit of medium to very dense, light gray, silty sand with pockets of clay was observed from elevations -56 to -130 feet NAVD88. This soil was found at the terminus of many of the 60-foot borings and was observed in the two 120-foot borings. In boring SJGB003, this unit was observed underlying the hard, dark gray clay with wood, existing as interbeds in the clay before gradually transitioning to a distinct layer and observed for a thickness of 9 feet until the extent of exploration was reached. In boring SJGB007, this unit was 39 feet-thick.

**Lower hard clay.** In boring SJGB007, a light bluish-gray layer of hard clay was observed underlying the lower layer of dense light gray sand. This lower layer of hard clay was observed from elevation -95 feet NAVD88 to the bottom of the exploration at -124 feet NAVD88 in SJGB007. An 11 foot-thick layer of this unit was observed in boring SJGB003 from -110 to -121 feet NAVD88. This material was very similar to the upper hard clay unit in terms of plasticity and grain size.

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## 1.2 Geotechnical Engineering Evaluations

As described in the Removal Action Work Plan (RAWP), the project entails placement of granular cover to stabilize Site sediments. This section describes the geotechnical engineering design evaluations performed to support the design of the granular cover. The following evaluations were made:

- Bearing capacity of the near-surface sediments was evaluated to determine their factor of safety to support the load imposed by granular cover.
- Slope stability was evaluated to determine the factor of safety of the granular cover when placed on the relatively steep slopes present in a small area of the Site.
- Filter criteria were evaluated to determine whether sediments in the submerged northwestern area of the Site could support the granular cover without migration of *in situ* sediments into the granular cover interstices.

## 1.3 Bearing Capacity of Sediments

Bearing capacity for the proposed cap was evaluated using methods described in Appendix C of the ARCS Program "Guidance for *In situ* Subaqueous Capping of Contaminated Sediments" (Palermo et al. 1998). When cap material is placed on the surface of soft sediments, there is a potential for a bearing capacity failure directly through the *in situ* sediment. The initial cap lift thickness must be thin enough to prevent a bearing capacity failure resulting from the weight of the cap.

In typical foundation design problems, a factor of safety of 3.0 is used for calculations where there is potential for structural damage or impact to human safety. This is the suggested factor of safety presented in the ARCS guidance. However, the guidance does not distinguish between short-term and long-term bearing capacity considerations. Because of the transient nature of short term loading, lower factors of safety are often considered in geotechnical engineering design. Experience on other capping projects has shown that a factor of safety of 3.0 can be overly conservative when considering construction lift thickness. Because life, safety, and structural stability are not design considerations, and due to the short duration of construction, a factor of safety of 1.5 was considered appropriate for use in this analysis for evaluating the design cap lift thickness. Subaquatic cap placement has been successfully demonstrated at multiple Sites when designed using a bearing capacity factor of safety of 1.5.

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This analysis evaluates the steady state, short-term stability of the cap and soft sediments during construction. Once the cap has been placed, consolidation of fine-grained *in situ* sediments will occur which will increase the shear strength of the sediment. Thus, the long-term stability of the cap against bearing capacity failure will be greater than the short-term stability.

The *in situ* sediments must have sufficient internal strength to prevent local shear failure. To evaluate this condition, the ultimate bearing capacity was calculated with the Terzaghi equations for local failure (Palermo, et al. 1998) using undrained shear strengths measured by *in situ* VST.

$$q_{ult} = \left(\frac{2}{3}\right) s_u * N_c \quad \text{(Equation H-1)}$$

Where:

$q_{ult}$  = ultimate bearing capacity of sediment (psf)

$s_u$  = undrained shear strength of *in situ* sediments from VST (psf)

$N_c$  = Bearing capacity factor (dimensionless) = 5.14 for continuous strip footing (Terzaghi and Peck, 1967)

This equation applies to a cap placed on the surface of an entirely cohesive soil with an angle of internal friction,  $\phi$ , equal to zero.

As previously discussed, during the May, 2010 field investigation, the undrained shear strength of the *in situ* sediments at the Site was measured at one-, two-, and three-foot depths using a field vane shear device. For determining the allowable thicknesses of the first lift of cap material, the 1-foot depth minimum value (38 psf) was used as a conservative first check:

$$q_{ult} = \left(\frac{2}{3}\right) 38 * 5.14 = 130 \text{ psf}$$

A factor of safety of 1.5 was used to compute the allowable bearing capacity:

---

$$q_{all} = \left( \frac{q_{ult}}{FOS} \right) \quad \text{(Equation H-2)}$$

Where:

$q_{all}$  = Allowable bearing capacity (psf)

FOS = Factor of Safety = 1.5

$$q_{all} = \left( \frac{130}{1.5} \right) = 87 \text{ psf}$$

The initial cap lift thickness that could be supported by the lowest strength *in situ* sediments without causing internal shear failure was calculated using the allowable bearing capacity and the following equation:

$$h = \left( \frac{q_{all}}{\gamma'} \right) \quad \text{(Equation H-3)}$$

Where:

$h$  = lift thickness

$\gamma'$  = buoyant unit weight of cap material, if submerged (pcf)

$$\gamma' = \gamma - \gamma_w$$

$\gamma$  = total unit weight of cap material (pcf)

$\gamma_w$  = unit weight of water (62.4 pcf)

$$\gamma' = 135 \text{ pcf} - 62.4 \text{ pcf} = 72.6 \text{ pcf}$$

$$h = \frac{87 \text{ psf}}{72.6 \text{ pcf}} = 1.2 \text{ feet} \approx 14 \text{ inches}$$

The analysis above, which uses the minimum *in situ* shear strength measured in the field, indicates a cap lift thickness of 14 inches can be placed while maintaining an adequate factor of safety against bearing capacity failure during construction.

The maximum cap thickness is proposed to be 2 feet. Using the analysis methods described above, the factor of safety against bearing capacity failure was computed assuming that the undrained shear strength after consolidation would be similar to the average measured *in situ*

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undrained shear strength at the 1-foot depth interval, or 160 psf. This analysis is intended to evaluate the long-term performance of the cap after construction has been completed. For a 2-foot thick cap, the factor of safety against bearing capacity failure is 3.8, which is adequate for support of the cap.

## **1.4 Slope Stability**

To evaluate the stability of proposed caps on slopes, a specific area of interest was identified at the Site. A representative section was selected that included a steep slope area where a 12-inch thickness of Armor Cap Material A ( $d_{50} = 3$  inches) coarse gravel material will be placed. Cross Section B is located at the northwest portion of the Site where the western cell transitions into the submerged northwest area (Figure H-1). Bathymetry indicates a relatively steep slope in this area of 2.25H:1V. Figure H-3 shows the interpreted Cross Section B-B that was used for slope stability analysis.

Slope stability was evaluated using Rocscience SLIDE 6.0 computer software for slope stability analysis. Soil profiles and properties are input in the model and then trial runs are conducted by the software to determine the critical slip surface – that is, the failure surface with the lowest factor of safety. The software uses limit equilibrium methods to calculate stresses (loads) and strength (resistance) for each slip surface evaluated.

General Limit Equilibrium (GLE) interslice force function methods were used for the analysis. Stability evaluations were conducted by inputting the geometry and stratigraphy of existing or proposed slopes and entering corresponding soil and water parameters (e.g. water elevations, soil strength model, soil density, cohesion, friction angle, etc.). The software processes this information to generate the factor of safety associated for the various failure surfaces evaluated.

*In situ* soil properties used for the slope stability evaluations were obtained from laboratory consolidated-undrained triaxial tests, physical property measurements, VST measurements, and correlations based on blow counts from samples collected during the field work described above. Additionally, physical properties of the proposed capping materials were estimated based on the nature of the proposed cap materials and estimated expected density. Table H-2 summarizes the input properties for the *in situ* and capping materials that were



used in the model. Both circular and non-circular surfaces were checked, and the software performed a search for the critical (i.e., lowest factor of safety) slip surface.

**Table H-2**  
**Soil Inputs for Slide 6.0 Slope Stability Analyses**

Material	Saturated Unit Weight (pcf)	Undrained Conditions		Drained Conditions	
		Friction Angle (degrees)	Cohesion (psf)	Friction Angle (degrees)	Cohesion (psf)
Armor Cap Material A	135	34	0	33	0
Soft Silt and Clay	107	0	40 + 20/ft up to 120	15	100
Light gray sand	110	29	0	29	0
Beaumont clay	120	0	1000	17	50

Based on the results of the stability analysis, the section evaluated is expected to have a static short term factors of safety of 1.3 or better, and static long-term factors of safety of 1.5 or better, which meet the criteria acceptable by the USACE (2003). Results of the stability analysis are presented in Table H-3.

**Table H-3**  
**Results of Slope Stability Analysis**

Conditions	Short Term		Long Term	
Failure surface	Non-circular	Circular	Non-circular	Circular
Soil Properties	Undrained	Undrained	Drained	Drained
Factor of Safety	1.42	1.43	2.05	2.09
USACE recommended FOS	1.3	1.3	1.5	1.5

Appropriate construction techniques should be used to limit the potential for slope instability during construction. This would involve the placement of materials in a “bottom up” fashion, whereby materials are first placed at the toe of a slope and construction proceeds towards the top of the slope. In this way, cap materials will be continually placed against a

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firm toe support to minimize the potential for cap material to ravel downslope. Materials should also be placed in lifts of approximately 6 inches along the face and top of the slope. This allows the soft silt and clay layer time to consolidate and develop extra strength.

## **1.5 Geotechnical Filter Design**

Based on conversations with contractors, construction in shallow water will require the use of land-based or marsh buggy equipment operating in contact with the ground. To facilitate access and operations, the contractors will place a geotextile on the surface of the sediment prior to placing the granular materials. In addition to providing separation and reinforcement to support construction activities, this geotextile will act as a filter layer to separate the relatively fine-grained sediment from the coarser grained granular materials that will be used to stabilize the Site.

In deeper water, placement of a geotextile will not be necessary to support construction because granular cover will be placed from the water side and construction equipment will not operate directly in contact with the ground (i.e. mudline) surface. Because of anticipated difficulties in placing a geotextile in deep water, the contractor will be provided a granular material specification that will act as a blended filter and armor layer for use in this area. This section describes the design of the gradation for the filter material and the required blending that will be necessary to combine the filter with the armor material for use in deeper water.

The area of interest for filter design is specifically the Northwestern Area, as described in the RAWP. Filter design criteria were evaluated to ensure that the blended armor/filter specification is sufficiently fine such that the *in situ* sediments do not migrate into the armor/filter material and sufficiently coarse so that the filter material is not washed out of the armor material.

Design methods described in Wright, et al. (2001) were used to select gradation of the filter material, and to develop the recommendations for blending the filter and armor material into a uniform single gradation for placement.

The following input assumptions were used in evaluating the filter gradation:

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Depth averaged river velocity in Northwest Area:	1.2 to 1.5m/s (100-year storm)
d <sub>85</sub> of <i>in situ</i> sediments:	0.14 to 0.19 mm
Layer thickness for blended armor/filter	12 to 18 inches

The evaluation of filter gradation criteria entails computing an acceptable range of d<sub>50</sub> for the filter material (a function of the d<sub>85</sub> of *in situ* sediments) and determining the d<sub>15</sub> and d<sub>100</sub> of the filter material using nomograms provided by Wright et al. (2001) (a function of d<sub>50</sub> of the filter material). The d<sub>85</sub> of the filter material is also checked for compatibility with the *in situ* sediment grain size and the armor material grain size using nomograms that are based on river velocity and thickness of the blended armor/filter layer.

Based on this evaluation, the following gradation was developed for the filter material. This material will be blended with the armor rock as described below.

**Table H-4**  
**Filter Material Gradation Requirements**

U.S. Standard Sieve Size	Percent Passing
3/8-inch	100%
U.S. No. 4	50 to 90%
U.S. No. 10	10 to 40%
U.S. No. 200	0 to 4%

As described in the hydrodynamic analysis (Appendix G), the Northwest Area will require an armor size with d<sub>50</sub> equal to 3 inches.

Also described in the work by Wright, et al. (2001) is the recommended blending of the filter material with armor material. Based on this work, a blend of 20 percent filter material to 80 percent armor material (by weight) will be used for the Cap Material A described in the specifications and presented on the construction drawings.

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## TABLES

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**Table H-1  
Vane Shear Test Results**

Test Location ID	Sample ID	Water Depth (feet)	Depth below mudline (feet)	Undrained Shear Strength ( $s_u$ ) (without rod friction correction)	
		(feet)	(feet)	Peak (lbs/ft <sup>2</sup> )	Remolded (lbs/ft <sup>2</sup> )
SJVS005	SJVS005-GR1	13	1	132	104
			2	321	113
			2.5	331	113
SJVS017	SJVS017-GR1	3.7	1	444	76
			1.9	869	227
			3	831	180
SJVS018	SJVS018-GR1	3.5	1	189	151
			2	737	94
			3	548	94
SJVS016	SJVS016-GR1	4.6	1	38	19
			2	38	38
			1	66	8
			2	44	13
			3	66	18
SJVS015	SJVS015-GR1	4.4	1	170	123
			2	123	85
			3	208	76
			1	73	73
SJVS011	SJVS011-GR1	4.2	1	331	151
			2	350	132
			3	378	161
SJVS012	SJVS012-GR1	4.7	1	217	76
			2	189	113
			3	293	113
			3	397	--
			0.7	73	--
SJVS010	SJVS010-GR1	2.7	1	67	16
			2	73	--
			1	85	85
			2	170	66
			3	198	94
SJVS013	SJVS013-GR1	1.4	1	302	66
			2	180	180
			3	350	123

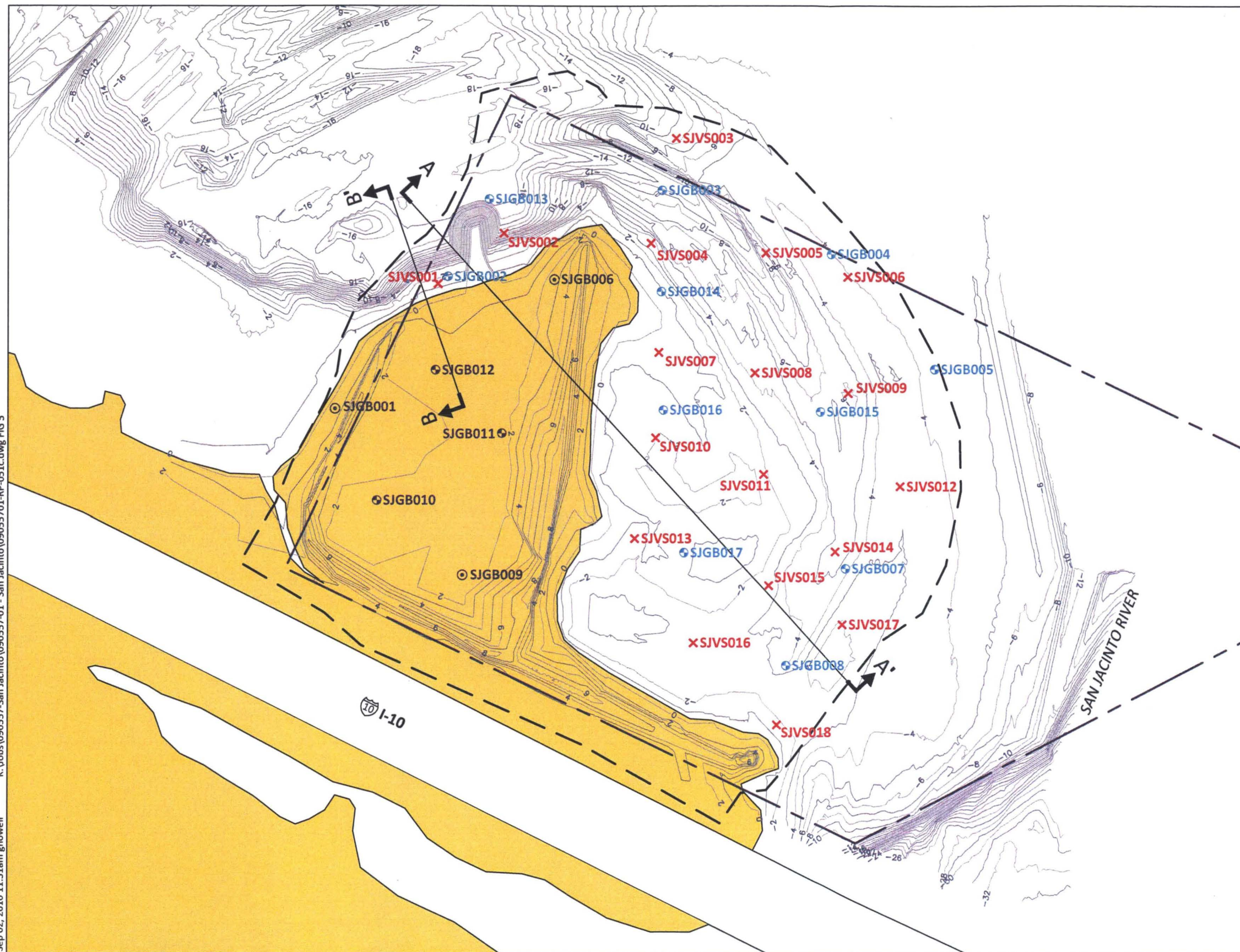
Test Location ID	Sample ID	Water Depth (feet)	Depth below mudline (feet)	Undrained Shear Strength ( $s_u$ ) (without rod friction correction)	
		(feet)	(feet)	Peak (lbs/ft <sup>2</sup> )	Remolded (lbs/ft <sup>2</sup> )
SJVS001	SJVS001-GR1	1.5	1	73	--
			1	66	47
			2	113	66
			3	132	47
SJVS002	SJVS002-GR1	13	1	76	113
			2	85	47
			3	85	94
SJVS003	SJVS003-GR1	6.6	1	331	66
			2	170	94
			3	520	180
SJVS004	SJVS004-GR1	3.6	1	208	104
			2	302	94
			3	265	104
SJVS006	SJVS006-GR1	4.6	1	189	66
			2	217	113
			3	283	66
SJVS007	SJVS007-GR1	0.9	1	208	28
			2	151	47
			3	142	85
SJVS008	SJVS008-GR1	6.1	1	142	113
			2	198	76
			3	236	104
SJVS014	SJVS014-GR1	6.7	1	151	47
			2	331	170
			3	444	161
SJVS009	SJVS009-GR1	7.7	1	94	66
			2	217	132
			3	444	180

## FIGURES

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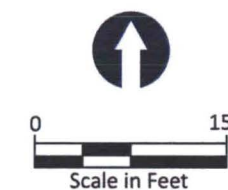


Sep 02, 2010 11:51am ghowell K:\Jobs\090557-San Jacinto\090557-01 - San Jacinto\09055701-RP-051c.dwg FIG 5



**LEGEND:**

- SJGB001 ⊙ Geotechnical Boring Sample Location (Proposed)
- SJGB016 ⊙ Geotechnical and Chemistry Sample Location (Proposed)
- - - - - Approximate 1966 Alignment of Perimeter Berms (EPA)
- - - - - Property Line
- Approximate Limit of Vegetated Area (Shoreline)
- × SJVS009 Vane Shear Test Location (Actual)
- ⊙ SJGB015 Geotechnical Boring Location (Actual)

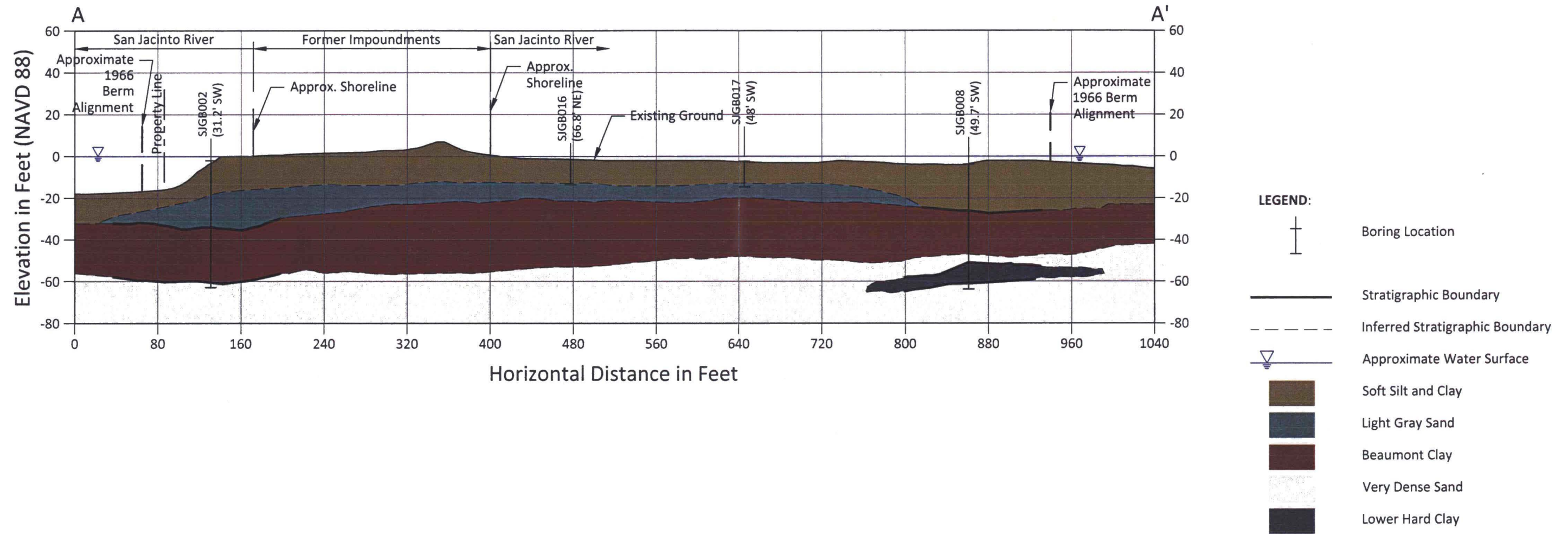


**SOURCE:** Drawing prepared from electronic file provided by US Army Corps of Engineers.  
**HORIZONTAL DATUM:** Texas South Central NAD 83, US Survey Feet.  
**VERTICAL DATUM:** NAVD 88.  
**NOTE:** Proposed boring locations are depicted in gray scale.



K:\Jobs\090557-San Jacinto\090557-01 - San Jacinto\09055701-RP-051c.dwg FIG 6

Sep 02, 2010 11:52am ghowell

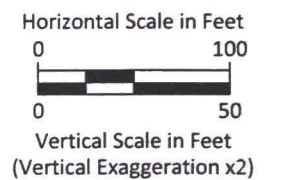


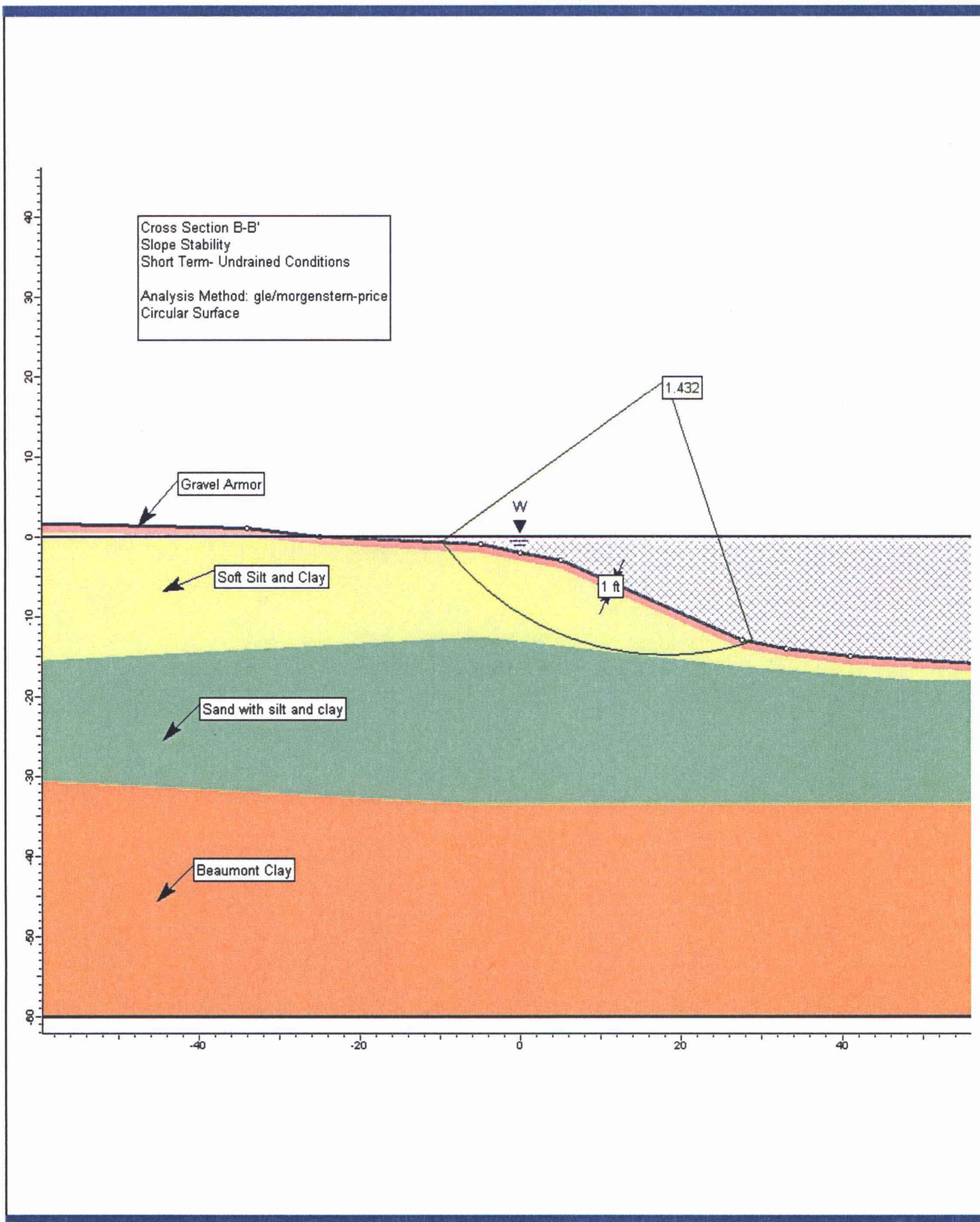
**HORIZONTAL DATUM:** Texas South Central NAD 83, US Survey Feet.

**VERTICAL DATUM:** NAVD 88.

**NOTES:**

1. BGS - Below Ground Surface
2. SJGB - Borings by MIMC / IPC
3. All stratigraphic boundary elevations are approximate.





**Figure H-3**

Slope Stability – Cross Section B-B  
 Appendix H – TCRA RAWP  
 SJRWP Site /MIMC and IPC

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# APPENDIX I

## BATHYMETRIC SURVEY AND ADCP DATA COLLECTION REPORT

### SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

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**Prepared for**

U.S. Environmental Protection Agency, Region 6

**On behalf of:**

McGinnes Industrial Maintenance Corporation

and

International Paper Company

**Prepared by**

Anchor QEA, LLC

614 Magnolia Avenue

Ocean Springs, Mississippi 39564

**September 2010**

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Figure 10	SonTek Argonaut-SW ADCP Deployment



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## **1 INTRODUCTION**

### **1.1 Brief Resume of Firm**

The hydrographic and topographic surveys were performed by Hydrographic Consultants. Hydrographic Consultants, Ltd. (HCL) in February 2009 and June 2010. HCL specializes in meeting the challenges of maintaining up-to-date standards and equipment in this ever-changing environment, with the purpose of providing service and support to both the public and private sector in pursuit of their hydrographic survey needs in the marine environment.

## **2 EQUIPMENT UTILIZED**

Topographic Equipment – set tide gauge from HGCSD 33:

- RTK – Trimble 5700/ Trimble 5800 with Trimmark III Radio
- RTK Software – Trimble Survey controller and Trimble Geomatics Office

Hydrographic Equipment:

- Echo sounder – Odom CV100 using a 4 degree 200 KHz transducer
- Positioning – Trimble DMS 232 using U.S. Coast Guard Navigation Beacon Corrections (DGPS – sub meter accuracy)
- Survey Software – Hypack operating on laptop with helmsman monitor
- Survey Vessel – HCL used the survey vessel “Surveyza” which is a 19 foot Carolina skiff with less than 1 foot draft. This type of vessel can operate in shallow waters which was necessary to cover the area required for this survey.
- Tide – HCL used 2 Onset gauges that use water pressure to monitor water elevation.

## **3 METHODS**

Project Manager, Mr. Robert A. Roman, P.E. is an American Congress Survey & Mapping Certified Inshore Hydrographer. All bathymetric surveys and data processing were under his direct supervision. He supervised the ADCP deployment and data extraction for the Anchor QEA, LLC team.

### **1. Tide Gauge(s)**

- 
- RTK technology was employed to check and set vertical control for monitoring the water elevation. Due to the extent of the project and the water constriction at the I-10 overpass, HCL proposed to monitor water elevations at 2 locations, upstream and downstream of I-10. The gauge deployed was dependent upon the area HCL was surveying on any particular day.
  - All vertical control was set from HGCS D 33 and checked to other HGCS D monuments in the area. If any discrepancies were found, HCL notified Anchor QEA immediately before continuing with work.
  - Tide gauges are electronic and measure water elevations based upon monitoring water pressure and barometric pressure (necessary to cancel out atmospheric effects on water pressure). Gauges monitored water elevation on 30 second intervals during the course of the survey.

## 2. Hydrographic Survey

- The hydrographic survey was performed using survey procedures, data collection equipment, methods and densities and equipment calibration for this work followed the criteria for Navigation and Dredging Support Surveys for soft bottom materials as given in the U.S. Army Corps of Engineers Hydrographic Survey Manual EM 1110-2-1003, dated January 2, 2002. HCL regularly performs hydrographic surveys to these standards and is thoroughly familiar with the USACE document and the accuracy requirements.
- As noted in Section 5.1.1 – the proposed grid was developed based upon both HCL's knowledge of the area and the requirements for preparing an accurate 3-D model.
- Surveys were to DGPS (sub meter) horizontal accuracy and to a vertical accuracy consistent with the USACE requirement for dredging support surveys for soft bottom materials.
- Surveys were conducted using hypack software integrated with the echo sounder and DGPS positioning systems to continuously in real-time record both position and depth along the course of each transect.

HCL utilized a shallow draft Carolina Skiff with a center hull transducer. This allowed HCL to maximize the access in the areas of limited depth of water. Additionally, HCL included

---

extra time in the cost proposal to account for having to cover much of the area during periods of high tide.

## **4 SURVEY FEBRUARY 2009**

### **4.1 Grid Survey Pattern Based on Knowledge of the Area**

HCL reviewed the primary survey area boundary in conjunction with aerial data of the San Jacinto Waste Pit Site and NOAA chart 11329 and concluded that a grid layout is not the optimal layout to economically model the area. Rather than survey a grid pattern, HCL proposed to survey a series of transects that best model:

- The San Jacinto River contour
- The terrain surrounding the waste pit Site, and
- Denote channel features surrounding or leading to the waste pit Site

GENERAL LAYOUT NOTE: HCL prepared the plan based on their knowledge of the area and as an efficient transect density to model the area for the RI/FS work plan. Anchor QEA added additional transects necessary to cover the area, HCL adjusted the proposal accordingly. The survey pattern for the area was laid out as such, with the area shown on Figure 8 being collected in the June 2010 effort as part of the TCRA activities:

#### **4.1.1 Section I – South of I-10**

The pattern for South of I-10 was a set of transects to map pattern of San Jacinto River as well as the area shown on NOTE A of Figure 1; this figure also displays the survey transects in red.

- Note A: A “Channel” is shown on the NOAA chart (dashed green area). HCL added transects to properly model this channel.

Also, HCL worked in this area before and much of the area noted as barge mooring area had barges and other vessels moored in that area. HCL worked around moored vessels, so the transect path deviated from the proposed path in areas where obstructions exist. Note that this area was not surveyed as part of the TCRA effort and is displayed to show continuity with the RI/FS Work Plan efforts.



---

#### **4.1.2 Section II – North of I-10**

The survey pattern displayed in Figure 2 consists of lines setup to best model the San Jacinto River Basin and general bathymetric contours shown on NOAA chart (Red Transects). Also, HCL defined what appeared to be a deeper area leading to the site (Blue Transects). Note Western most Blue transect, is Anchor QEA's Line #15.

The hatched portion of Figure 2 is the area immediately surrounding the waste pit area. The survey pattern for this area was not based on the NOAA charts, rather on the interpretation of aerial data. Section 5.1.3 details the work done in this area.

#### **4.1.3 Section III – Surrounding Area of Waste Pit Site**

Through a review of aerial data, HCL identified underwater bottom features visible at low tide. The hatched area in Figure 2 represents the surrounding area and waste pit site. Figure 3 shows an oblique view of the area where shallow water can be seen as well as cuts through the area. Also visible are remnants of land on the lower left near I-10.

Figures 2 and 4 show the I-10 North plan based on the NOAA contours, with Figure 4 showing an overlay on a low tide aerial photo. As Figures 3 and 4 shows, there are other features that needed to be defined to accurately model the area. A deep area that appears to connect with the "channel" leading into the back of the pit site is visible. Also visible are shallow bank areas surrounding the deep area. These areas in addition to the cut across the top of the area, peninsula and other features visible at low tide needed to be surveyed.

HCL denoted some of the additional bathymetry (blue lines) that were used to map features not visible on the NOAA chart, but visible in the aerial photos (most notably defining the shallow banks surrounding the deep water. However, other bathymetry was taken as needed in the field to document the existing bottom features as visible on the aerial data.

Additionally, much of these features are shallow – so this area needed to be covered at high tide.

---

HCL allotted time in the cost proposal to pickup any features that were noticed in the field that were not adequately covered to model the area for development of the 3 foot X 3 foot grid or CAD contours.

## **4.2 Description of Interpolation Method to Generate 3-Foot Grid Data**

### **4.2.1 3-D Modeling Method**

To develop the 3 foot X 3 foot Grid a 3-D model from the survey was first developed. HCL utilized Trimble's Terramodel software for 3-D modeling. The key to any modeling is to;

- Collect data in such a manner that there is both sufficient density and data is collected at key contour changes and perpendicular to those contour changes. The survey pattern for the prepared by HCL in the designated area has been setup to provide sufficient data at key locations to economically model the area.
- Aid the modeling process by using break lines to link points of similar elevation and "steer" or direct the linking of data such that the model best reflects the actual conditions. Without break lines the closest points are linked and in most instances the computer software alone will not correctly model the area. (see example below)

Figure 5 shows a survey where the survey lines (magenta) were taken perpendicular to a contour (in this case a pipeline). Below the survey pattern in Figure 5 is Terramodel's 3-D model based on survey line data. In general the pipeline was discernable in the model.

Figure 6 shows a survey where the data was taken askew of the pipeline. This would be an example of the data not being perpendicular to a contour. The result was that the software created a 3-D model that was not representative of the area. Instead of 1 pipeline it appeared that multiple ridges exist.

This is an example of how the software alone could not generate the contours – the software linked the closest points, not the natural contour. Figure 7 on the following shows how the data processors used break lines to aid the modeling of the data even in situations where the data were not perfectly perpendicular to the contour.

---

By using break lines to aid in 3-D modeling, even in the worst circumstances (lines askew to the natural contour) a surface can be developed. In Figure 7, break lines were added to show how the data points should be linked. The result was a surface that, although not as perfect as that shown in Figure 5, provided a reasonable representation of the bottom.

The purpose of this example is to demonstrate that computer software alone does not inherently provide the best surface model of an area. As such, HCL 1) prepared a survey plan that provided the best starting point for a computer modeling of the area and 2) included in the budget data processor time to develop the model from the survey data acquired.

Once the base survey data were edited, it was color plotted and overlaid in such a manner that the data processor determined where break lines needed to be added. Additionally, as HCL prepared the survey layout with the assistance of the NOAA charts, HCL also used those charts with their contouring to assist in placing break lines.

The final stage was to review the 3-D model of the survey to ensure that the model properly reflected the bottom topography. Once the 3-D model was developed and accepted then the "Terramodel" software generated data on a 3 foot X 3 foot grid.

## **5 SURVEY JUNE 2010**

### **5.1 Survey Pattern Based on Knowledge of the Area**

HCL revised the layout per the information provided by Anchor denoting the areas of concern. Figure 8 below displays the revised layout.

### **5.2 ADCP Deployment**

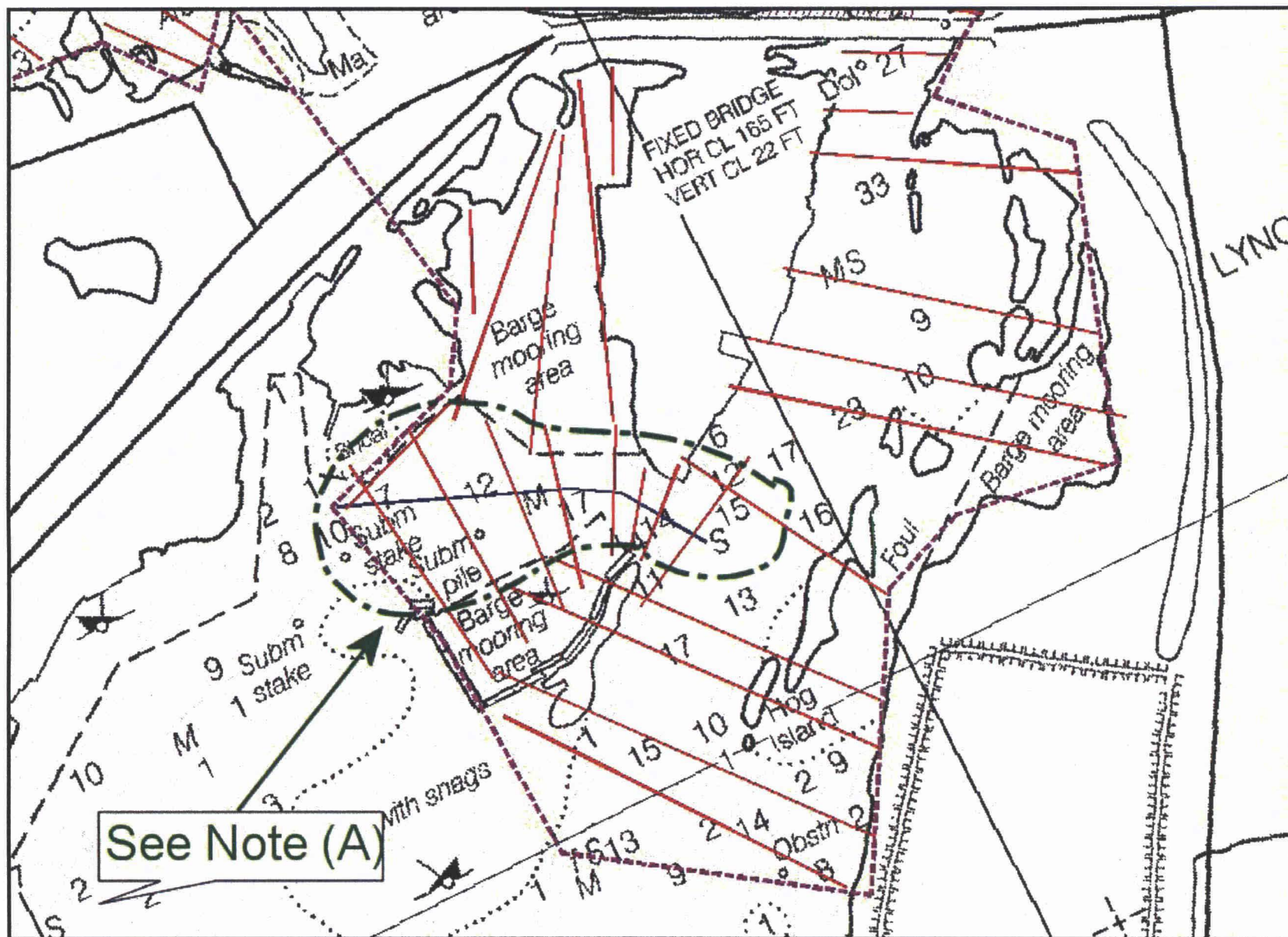
HCL deployed Anchor QEA's SonTek Argonaut-SW ADCP at the location specified in the work plan. Figure 9 displays SonTek's specifications sheet for the Argonaut-SW, and Figure 10 displays the gage deployment platform. HCL also retrieved, managed, and downloaded the ADCP data. These data collected were necessary for Anchor QEA's draft hydrodynamic model simulations.

---

Data was collected for the 21 day period from June 16, 2010 to July 6, 2010, to calibrate the hydrodynamic model. A plot of the data and the ADCP deployment location are shown in Figures 10, 11, and 12 of Appendix G.

## FIGURES

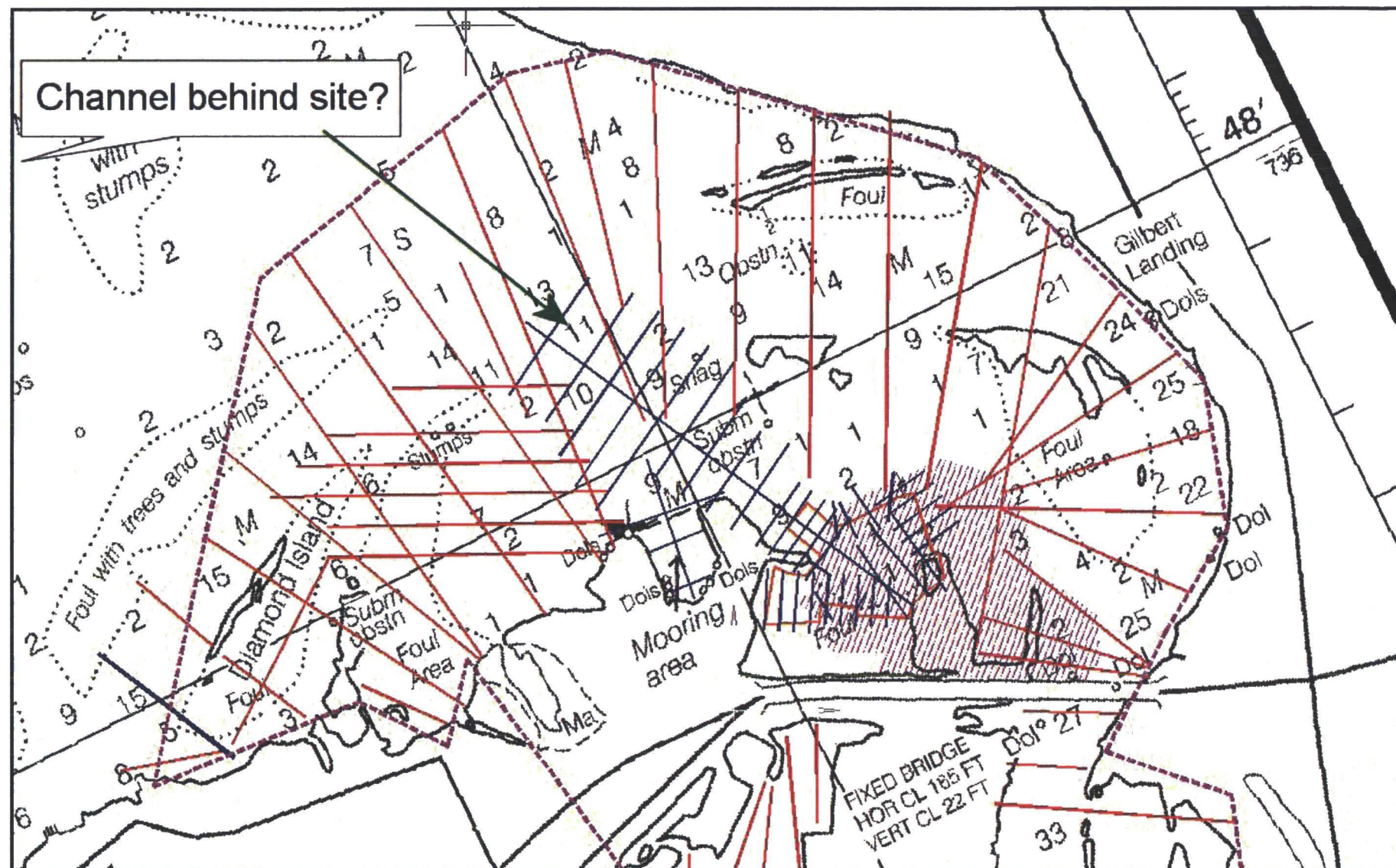
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**Figure 1**

Survey Layout South of I-10  
Hydrographic Survey and ADCP Data Collection  
San Jacinto River Waste Pits Superfund Site

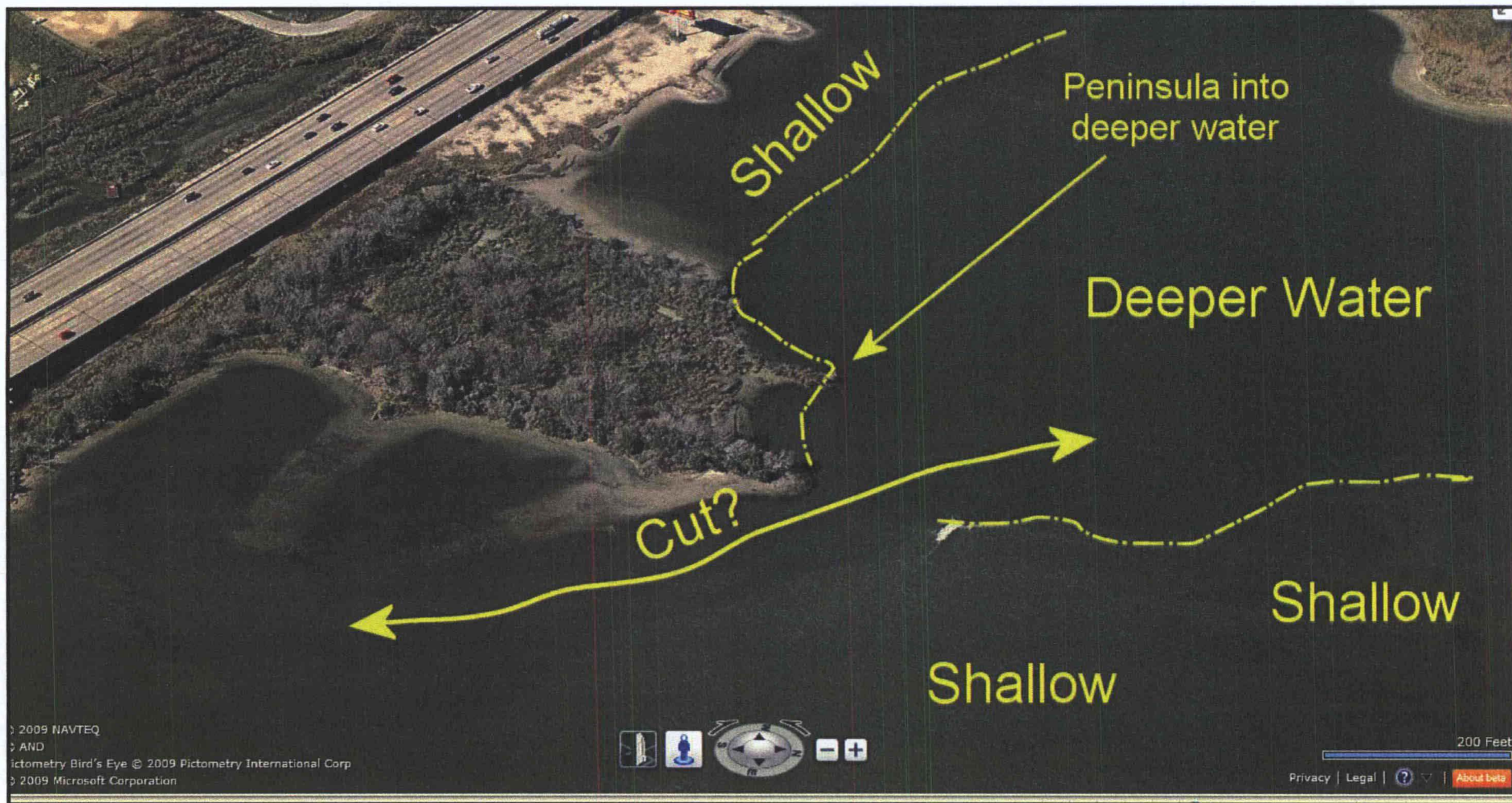




**Figure 2**

Survey Layout North of I-10  
Hydrographic Survey and ADCP Data Collection  
San Jacinto River Waste Pits Superfund Site







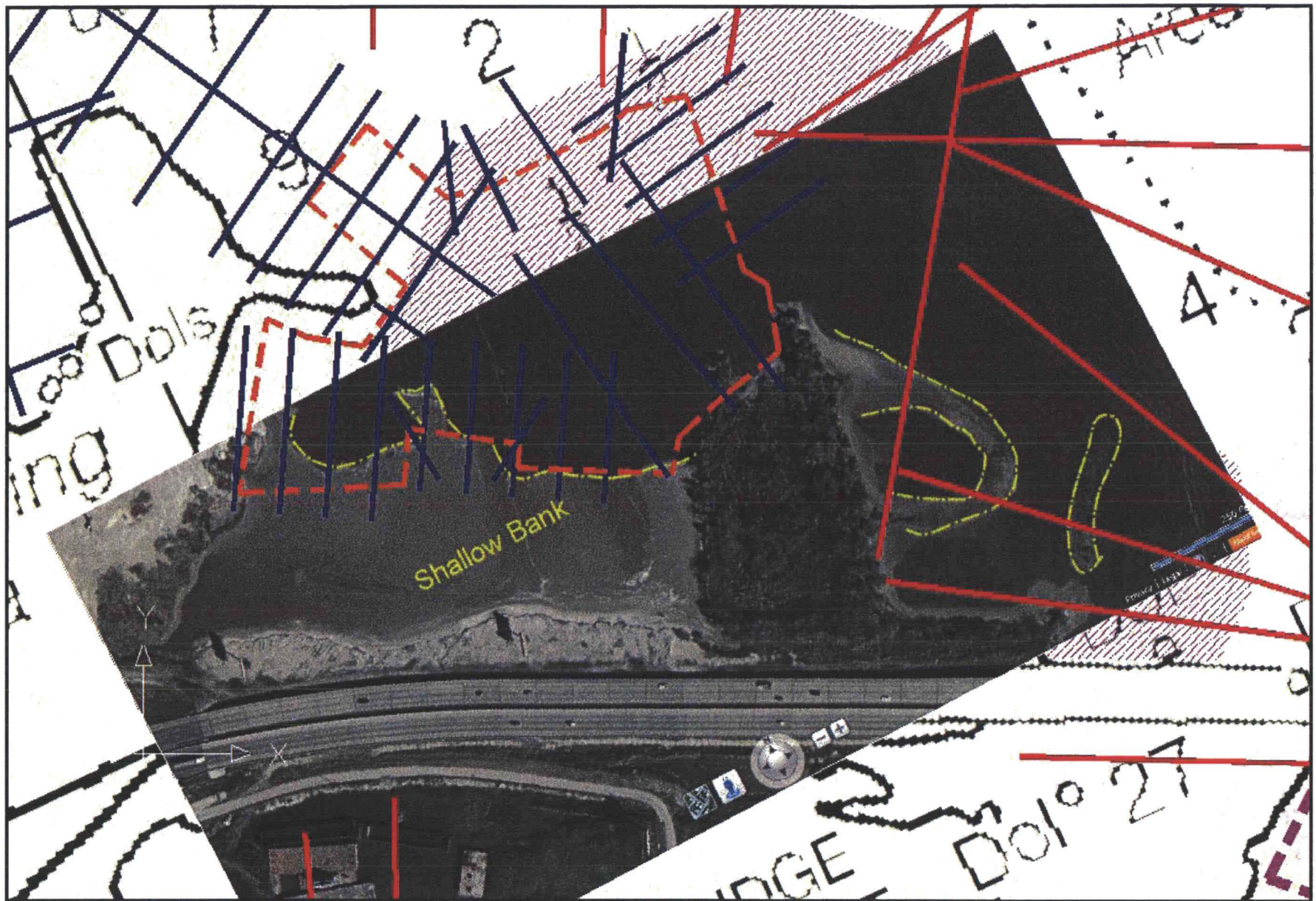
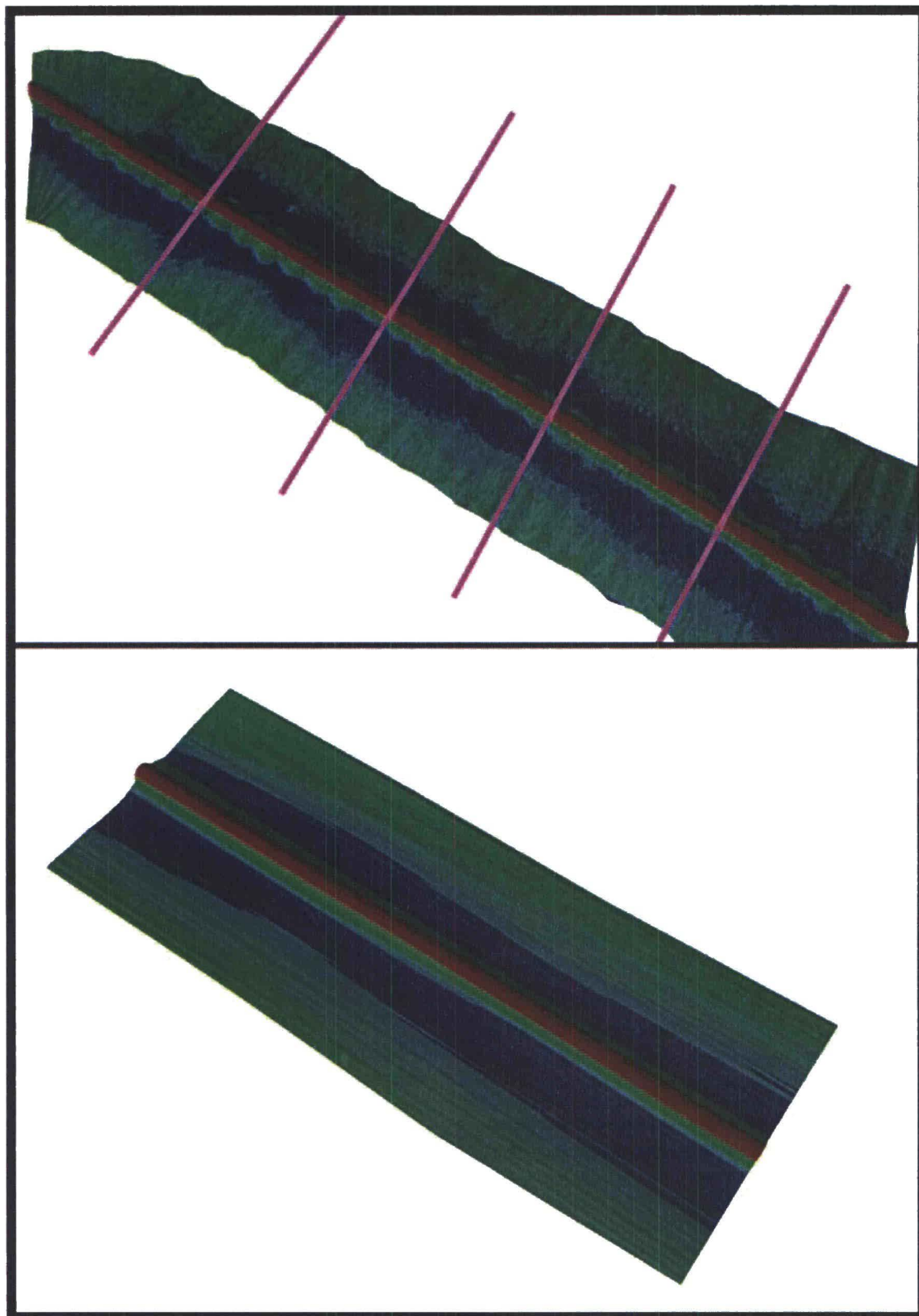


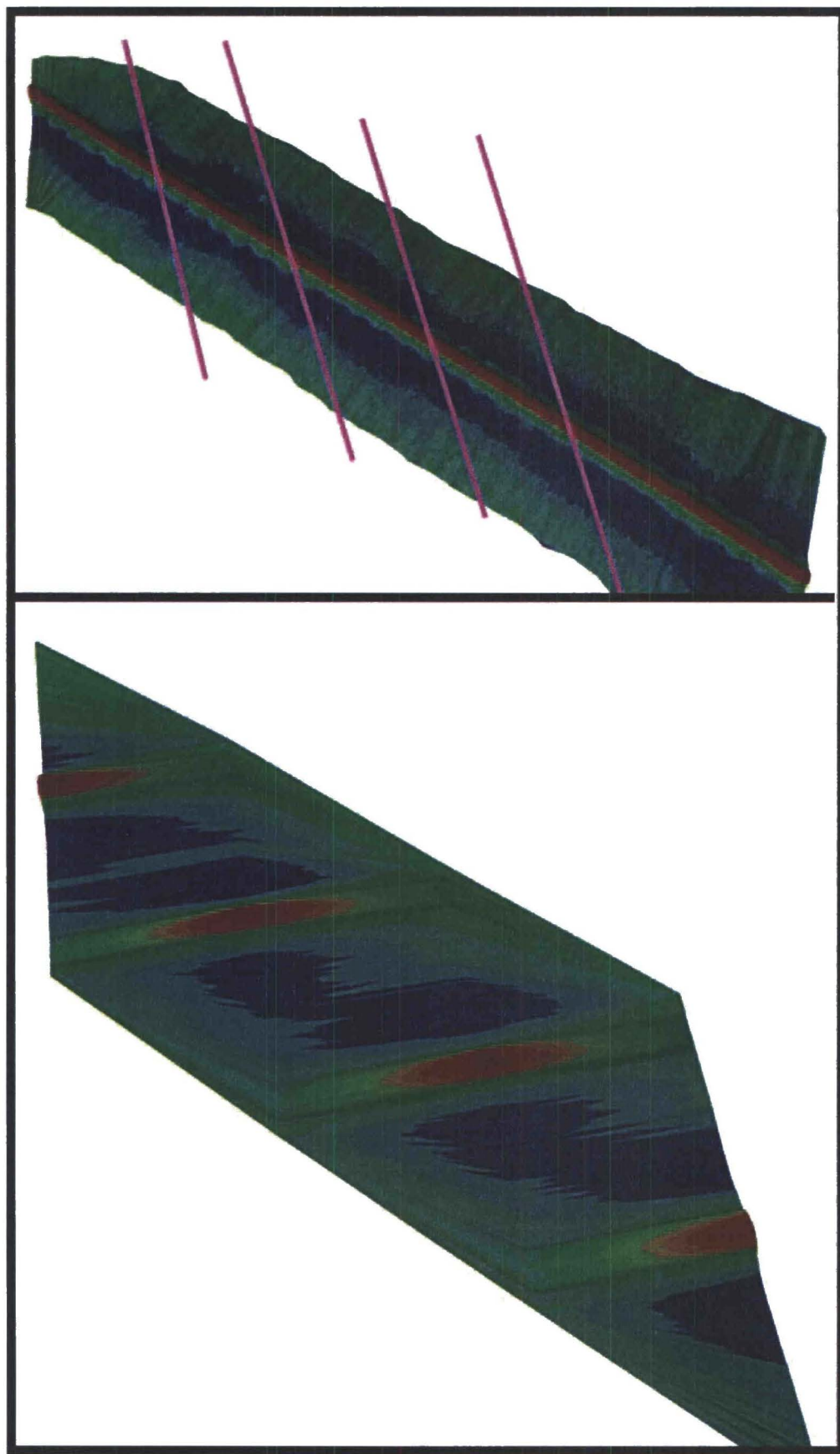
Figure 4

I-10 North Plan on Aerial Image of Waste Pit at Low Tide  
Hydrographic Survey and ADCP Data Collection  
San Jacinto River Waste Pits Superfund Site

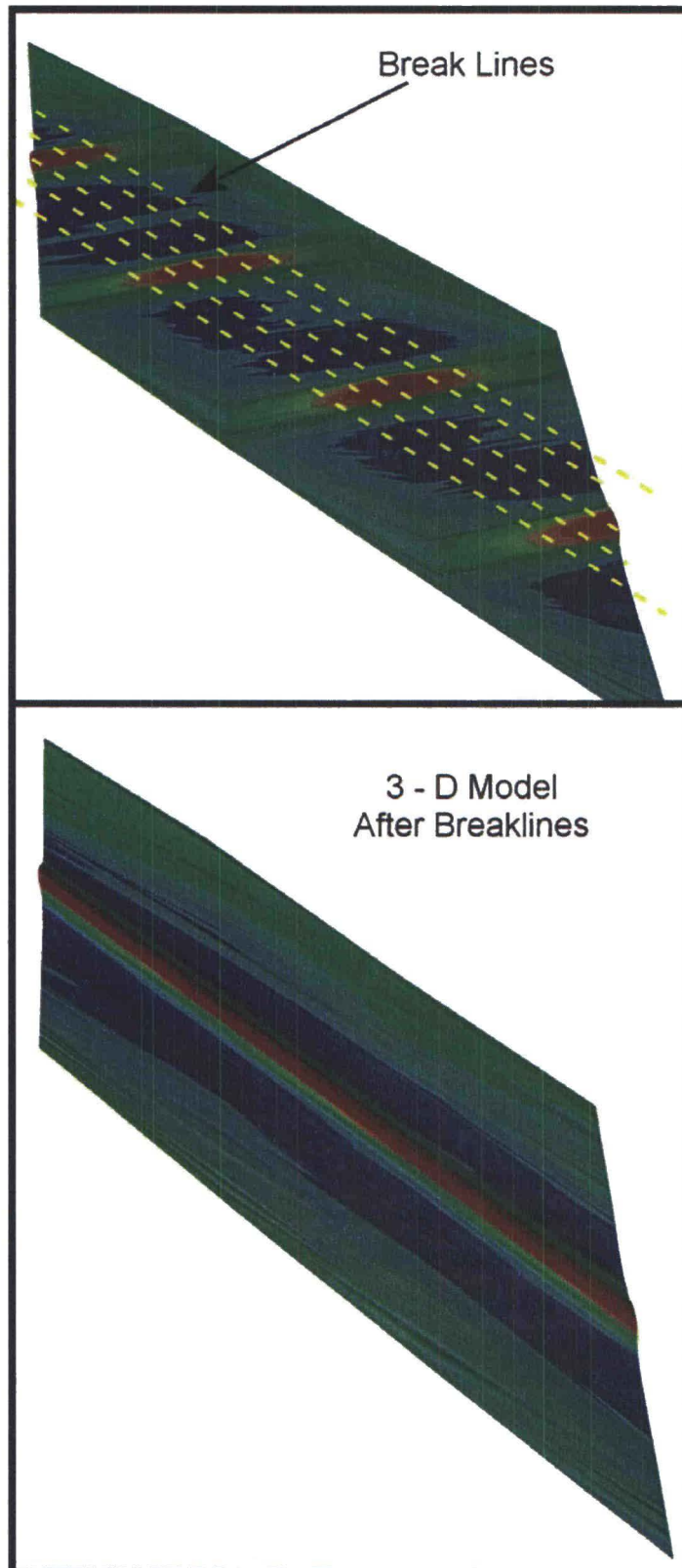


**Figure 5**  
Survey Perpendicular to Contour  
Hydrographic Survey and ADCP Data Collection  
San Jacinto River Waste Pits Superfund Site



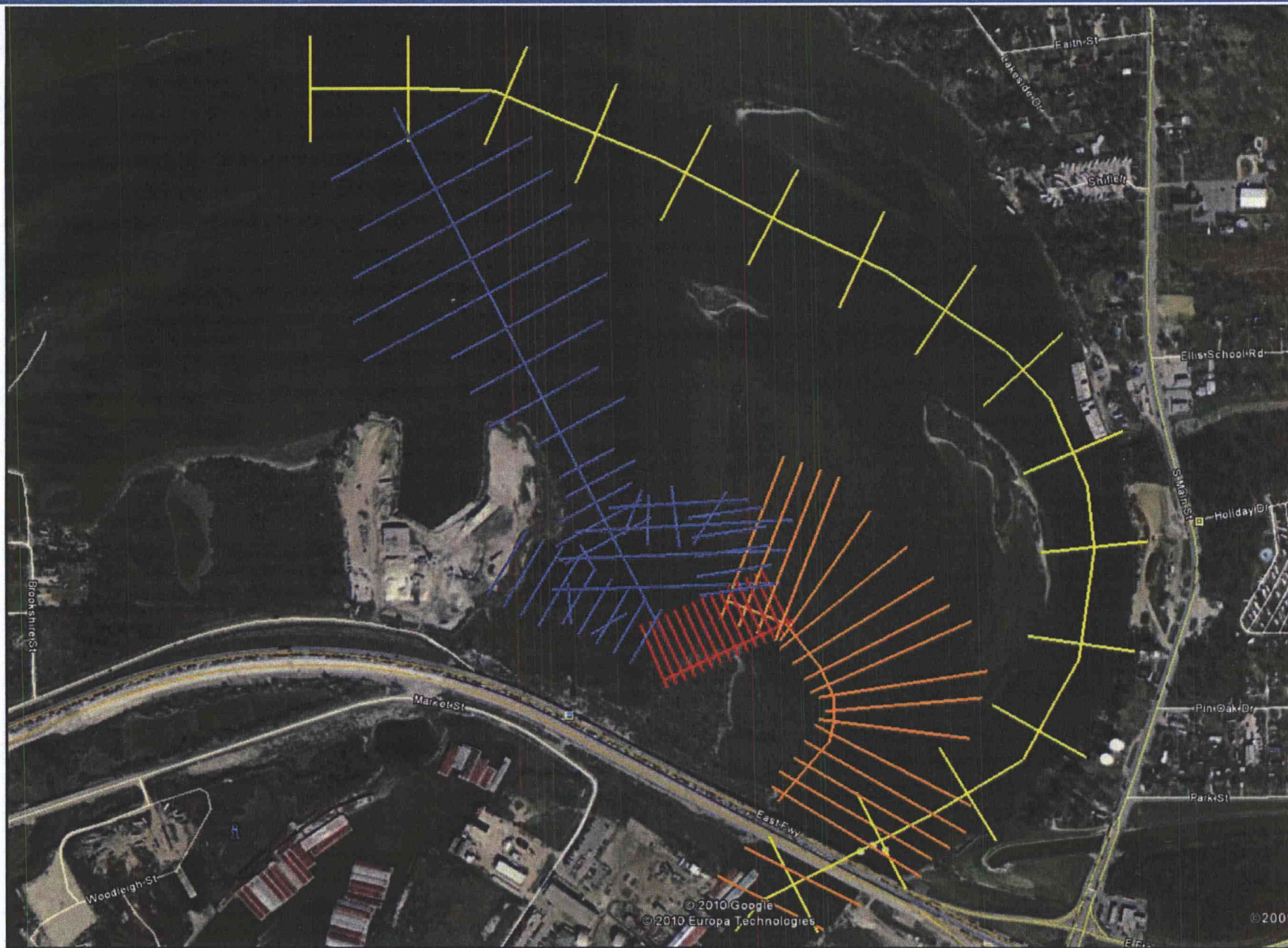


**Figure 6**  
Survey Askew of Contour  
Hydrographic Survey and ADCP Data Collection  
San Jacinto River Waste Pits Superfund Site



**Figure 7**  
Break Line Aiding for 3-D Modeling  
Hydrographic Survey and ADCP Data Collection  
San Jacinto River Waste Pits Superfund Site





**Figure 8**  
 Revised Survey layout, June 2010  
 Hydrographic Survey and ADCP Data Collection  
 San Jacinto River Waste Pits Superfund Site



# Argonaut-SW Specifications

Useful options and accessories make the Argonaut-SW a complete, turn-key solution!



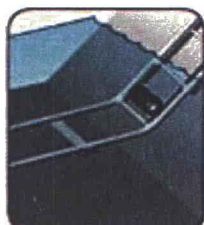
**Real-time Flow Display:** Provides an easy-to-use interface for monitoring both output data and the system status.



**SW Mounting Shoe:** This streamlined, hard plastic casing helps deflect sediment in canals, channels and pipes. Also has slots for pipe-rig mounting.



**Modbus Interface Module (MIM):** Integrate into any Modbus-enabled system using Modbus RS-232 protocol. Acting as an RTU slave device, the MIM stores data in a series of registers so it can be reported to the master unit in real-time.



**Sliding Mount:** Rail system for easy instrument deployment and retrieval. A modular design allows for multiple length and depth configurations.

## Standard Features

- 2-D velocity measurement (using 2 acoustic beams) along channel and vertical velocity components
- Water level measurement using vertical acoustic beam
- Automatically adjusts sampling volume location to measure the maximum possible portion of the water column
- RS-232/SD-12 communication protocol
- Real-time flow calculations using user-supplied channel geometry
- 4 MB recorder capacity (over 50,000 samples)
- Temperature sensor
  - Resolution:  $\pm 0.01^\circ\text{C}$
  - Accuracy:  $\pm 0.5^\circ\text{C}$
- ViewArgonaut Windows 2000/XP/Vista software for instrument setup, data collection, and post processing.
- PDA software (SonUtils and deployment module)
- Multi-cell current profiling
- Mounting plate

## Velocity Profiling Range

- Maximum Depth: 5.0m (16ft)
- Minimum Depth: 0.3m (1ft)\*

## Water Level Measurement

- Minimum Depth:
  - Above transducer: 0.10m (0.3ft)
  - Total water depth: 0.20m (0.6ft)
- Maximum depth: 5.0m (16ft)
- Accuracy:  $\pm 0.1\%$  of measured level,  $\pm 0.3\text{cm}$  (0.01ft)

## Water Velocity

- Range:  $\pm 5\text{ m/s}$  (16 ft/s)
- Resolution:  $0.1\text{ cm/s}$  (0.003 ft/s)
- Accuracy:  $\pm 1\%$  of measured velocity,  $\pm 0.5\text{ cm/s}$  (0.015 ft/s)

## Optional Features

- FlowPack velocity indexing software
- 4-20 mA and 0-5VDC output modules; possible variables are X velocity, Y velocity, velocity magnitude, temperature, SNR, stage, volume and flow.
- Custom mounting shoe (at left)
- Deployment sliding mount (at left)
- Flow Display (at left)
- Durable plastic shipping case
- RS-422 for cable runs longer than 100m



YSI Environmental Systems

SonTek/YSI  
5940 Serrano Ridge Road  
San Diego, CA 92121, USA  
Tel: +1 (858) 546-8327  
Fax: +1 (858) 546-8150  
Email: inquiry@sontek.com

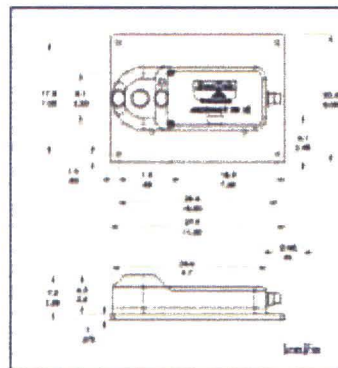
## Physical Parameters

- Dimensions: 24.5cm (9.7 in) long by 10cm (4 in) wide by 6.3cm (2.5 in) high
- Weight:
  - In air: 1.2kg (2.6 lb)
  - In water: 0.15kg (0.3 lb)
- Pressure rating: 25m (80 ft)
- Operating temperature:  $-5^\circ\text{C}$  to  $60^\circ\text{C}$  ( $23^\circ\text{F}$  to  $140^\circ\text{F}$ )
- Storage temperature:  $10^\circ\text{C}$  to  $70^\circ\text{C}$  ( $14^\circ\text{F}$  to  $158^\circ\text{F}$ )

## Power Requirements

- Input power: 5-15 VDC
- Power consumption: 500 mW nominal

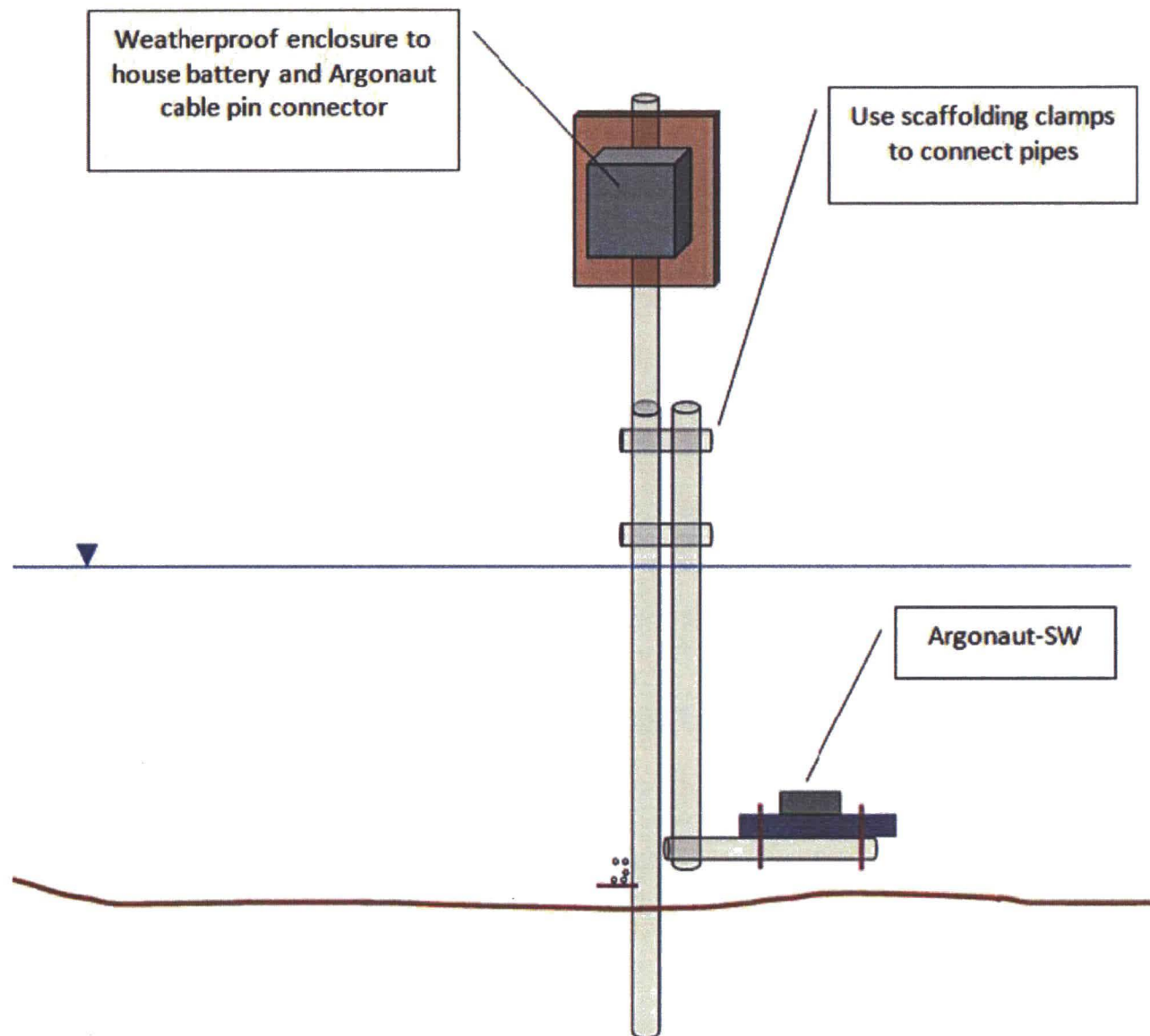
\*Can operate in shallower depths down to 0.2m (0.7ft) with performance limitations. Contact SonTek for details.



SonTek/YSI, founded in 1992 and advancing environmental science in over 100 countries, manufactures affordable, reliable acoustic Doppler instruments for water velocity measurement in oceans, rivers, lakes, harbors, estuaries, and laboratories. SonTek/YSI is an employee-owned company.

SonTek and Argonaut are trademarks of YSI Inc., Yellow Springs, OH, USA. The Argonaut-SW is made in the USA. Lit. code 506-02-0509, June 2009. Specifications are subject to change without notice.

[sontek.com](http://sontek.com)



**Figure 10**

SonTek Argonaut-SW ADCP Deployment  
Hydrographic Survey and ADCP Data Collection  
San Jacinto River Waste Pits Superfund Site